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UNITED STATES DEPARTMENT OF AGRICULTURE • Agricultural Marketing Service
Agricultural Research Service

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Forecasting Date of Volume Movement of Colorado Peaches

By J. W. Gannaway and William J. Cremins

As a means of forecasting probable maturity dates of standard Elberta peaches, the growers in Mesa County, Colo., in past seasons have had only the 126-day average elapsed time from full bloom to the date of shipment of the first car. Methods for forecasting maturity dates more accurately than those formerly used were developed by the authors and are described in this paper. Empirical methods, utilizing daily maximum temperatures from full bloom until June 30, gave calculations accurate within plus or minus 3 days in 25 of 26 years, relative to the first 25-car day, and in all 26 years relative to the first carlot equivalent. The new methods appear to offer a means to enhance harvesting and marketing operations, effect financial savings, and reduce waste.

AN ACCURATE FORECAST of the beginning of volume movement of standard Elberta peaches from Mesa County, Colo., could effect a more orderly and timely arrival of picking and packing labor, inspectors, buyers, trucks, and refrigerator cars than the industry has had, and it would enhance marketing procedures generally.

During the 1957 harvest season, for example, Mesa County was plagued for many days with between 3,000 and 4,000 idle migrant workers. Occasionally, under such conditions, enough of the labor force to cause concern moves on in search of immediate income. In other years, peaches are ready before the labor supply is adequate. The aggregate cost of retaining idle inspectors and buyers and the revenue loss to idle transportation facilities justify a serious effort to develop a relatively accurate method of forecasting volume peach movement early enough in the season to avoid most of these problems. For practical reasons, July 1 is regarded as the latest completely useful date for such a forecast.

The method of estimating harvest dates relied upon by the industry in the past has utilized the long-term average of days elapsed from full bloom to shipment of the first carlot equivalent of standard Elbertas. The average, 126 days, falls within extremes of 119 and 131—historical errors of 7 and 5 days, respectively. Reduction of this error to 3 days or less was the objective of our study. For clarity and want of a better term the prevailing method is referred to as the "industry method."

The study that was the basis for this report was initiated by the senior author 2 years ago. He undertook the study in the hope that weather data might yield a more reliable method of forecasting

the beginning of volume peach shipments. Early efforts were confined to monthly average data and deviations thereof from normal. The results were inconclusive, but they suggested the probability that daily data in some form would produce a reliable method.

Maximum Temperature the Yardstick

The daily maximum temperature, a recognized yardstick of photosynthesis, was judged to be the criterion most likely to explain differences in elapsed time from full bloom to harvest. Optimum temperatures for peach development range roughly from 54 to 72 degrees Fahrenheit, although at ripening the range narrows toward the upper limit with little development of consequence below 68 degrees.[1]

Fortunately for our purpose, a maximum temperature below 75 degrees rarely is reached in July and August. Maxima range rather consistently between 80 and near 100, and usually are above the threshold value during all daylight hours. It is this climatic feature that facilitates development of a forecasting procedure fitting the specifications of earliness (no later than July 1) and of suitable accuracy.

For all practical purposes then, the period from July 1 to harvest can be considered analogous from year to year. Temperature requirements are met every day alike, whether the maximum is 80 or 100. Hence, if temperature is a reliable measure, any difference of consequence in elapsed time from full bloom to maturity should be detectable in maximum temperatures experienced before July 1. This appears to be borne out, yet it is contrary to the consensus of the industry, which tends to hold that midsummer weather has the greatest influence on harvest dates.

Many empirical methods that utilize variations of accumulated heat units were sampled. The most satisfactory methods—the ones described here—use a reversal of this procedure, whereby a base number of days to maturity is established, to which noncreditable days are added.

Two different base numbers of days were utilized, one the least number of days ever experienced from full bloom to shipment of the first carlot equivalent, and the other the least number of days ever experienced from full bloom to the first day shipments reach or exceed 25 cars per day. These bases were 119 and 123 days, respectively. It should be pointed out that these figures represent years virtually void of cool weather in the postbloom period.

Noncreditable days are those before July 1 when maximum temperature fails to rise into, or above the optimum range of 54 to 72 degrees. Obviously, not all temperatures in the optimum range are equally effective. Peaches would be expected to develop more slowly at the lower limits of this range than at the upper. Arbitrary values, realized from trial and error, were assigned to certain maximum temperature intervals within the optimum range, rating their relative effectiveness. Specifically, maxima below 54 degrees equal one full noncreditable day; 54 to 60 degrees equal two-thirds of a day; 61 to 65 degrees equal a third of a day; and all maxima above 65 degrees are assumed to be fully and equally creditable.

In calculating the number of days from full bloom to shipment of the first carlot equivalent, if 3 days failed to reach 54 degrees, the fruit-development period would be lengthened by 3 days; in other words, 3 days would be added to the base figure of 119, making 122 days. Should 3 days range between 54 and 60 degrees, 2 additional days would be added, making 124; and should 3 days range between 61 and 65 degrees, one more day would be added, bringing the total to 125 days. Thus 125 days would be expected from full bloom to shipment of the first carlot equivalent.

Further Refinement Necessitated

Year-to-year variations in the date of full bloom, varying historically from March 27 to April 27, necessitated further refinement to take account of the fact that years of unusually early bloom invariably required more than the average number of days to maturity. An explanation may lie in the shorter days and the frequently greater diurnal fluctuations in temperature experienced before the average date of full bloom, when maximum temperatures would be expected to remain in the optimum range for shorter intervals.

[1] Gardner, V. R., Bradford, F. C., and Hooker, H. D. THE FUNDAMENTALS OF FRUIT PRODUCTION. McGraw-Hill, New York, 1939. Pp. 267–283.

TABLE 1.—*Comparison of authors' method, industry method, and observed number of days from full bloom to first carlot equivalent of standard Elberta peaches, Mesa County, Colo.*

Year	Observed days to first car X_o	Adjustments		119-day base to first car plus X_1 and X_2 X_{oe}	Difference $X_{oe}-X_o$	Industry estimate (mean of X_o) X'_{oe}	Difference $X'_{oe}-X_o$
		Noncreditable days X_1	Earliness X_2				
1931	126	7	0	126	0	126	0
1932	126	7	0	126	0	126	0
1933 [1]							
1934	129	5	5	129	0	126	−3
1935	129	9	0	128	−1	126	−3
1936	121	4	0	123	2	126	5
1937	125	4	0	123	−2	126	1
1938	124	6	0	125	1	126	2
1939	119	0	0	119	0	126	7
1940	126	6	2	127	1	126	0
1941	129	8	0	127	−2	126	−3
1942	131	11	0	130	−1	126	−5
1943	130	8	2	129	−1	126	−4
1944	125	8	0	127	2	126	1
1945	127	5	0	124	−3	126	−1
1946	124	2	0	121	−3	126	2
1947	130	8	1	128	−2	126	−4
1948	120	4	0	123	3	126	6
1949	123	2	0	121	−2	126	3
1950	127	8	0	127	0	126	−1
1951	123	4	0	123	0	126	3
1952	121	3	0	122	1	126	5
1953	126	9	0	128	2	126	0
1954	127	5	2	126	−1	126	−1
1955	122	4	0	123	1	126	4
1956	124	4	1	124	0	126	2
1957	130	14	0	133	3	126	−4

[1] Data missing.

X_o: Observed number of days from full bloom to first carlot equivalent.

X_1: Number of days discounted for low maximum temperature. Scored 1 day if maximum below 54 degrees; ⅜ of a day if 54 to 60; ¼ of a day if 61 to 65. Surplus fractions omitted, i. e., 2⅝ equals 2.

X_2: Earliness adjustment, ¼ of a day added for each day full bloom occurred before the April 16 average. Surplus fractions omitted, i. e., 2¾ equals 2.

X_{oe}: Historical average number of days from full bloom to first carlot equivalent.

An adjustment factor for early bloom therefore was incorporated by adding a fourth of a day for each day by which full bloom occurred earlier than the April 16 average. In the example described above, if full bloom occurred on April 12, 4 days earlier than average, one full day would be added to the 125 already accumulated, and 126 would be the forecast number of days from full bloom to the first carlot equivalent.

Early trials assumed that a similar but reversed adjustment would be necessary to take account of late bloom. It was indicated, however, that the factors making such adjustment for early bloom necessary tend to become less important as the season advances, as no clear association of late bloom with fewer than average days to maturity was established.

Old and New Methods Compared

The two methods, one forecasting the first carlot equivalent, the other the first 25-car day, were compared with the industry's forecasting methods. The years 1931 through 1957 were used—1933 was omitted for lack of data. It was deemed advisable to consider forecasting on both bases because, while the industry appears to be most concerned with the first carlot equivalent shipped, the date thereof can be influenced by a number of personal or individual factors other than maturity. The first 25-car day is deemed to be more reliable as a measure of readiness for harvest as, of necessity, it represents the composite maturity judgment of a number of growers.

TABLE 2.—*Comparison of authors' method, industry method, and observed number of days from full bloom to first 25-car day of standard Elberta peaches, Mesa County, Colo.*

Year	Observed days to first car X_o	Adjustments		123-day base to first car plus X_1 and X_2 X_{oe}	Difference $X_{oe}-X_o$	Industry estimate (mean of X_o) X^1_{oe}	Difference $X^1_{oe}-X_o$
		Noncreditable days X_1	Earliness X_2				
1931	130	7	0	130	0	130	0
1932	131	7	0	130	−1	130	−1
1933 [1]							
1934	135	5	5	133	−2	130	−5
1935	134	9	0	132	−2	130	−4
1936	124	4	0	127	3	130	6
1937	129	4	0	127	−2	130	1
1938	131	6	0	129	−2	130	−1
1939	124	0	0	123	−1	130	6
1940	131	6	2	131	0	130	−1
1941	134	8	0	131	−3	130	−4
1942	132	11	0	134	2	130	−2
1943	133	8	2	133	0	130	−3
1944	130	8	0	131	1	130	0
1945	129	5	0	128	−1	130	1
1946	127	2	0	125	−2	130	3
1947	133	8	1	132	−1	130	−3
1948	124	4	0	127	3	130	6
1949	125	2	0	125	0	130	5
1950	129	8	0	131	2	130	1
1951	126	4	0	127	1	130	4
1952	123	3	0	126	3	130	7
1953	127	9	0	132	5	130	3
1954	131	5	2	130	−1	130	−1
1955	127	4	0	127	0	130	3
1956	128	4	1	128	0	130	2
1957	135	14	0	137	2	130	−5

[1] Data missing.

X_o: Observed number of days from full bloom to first 25-car day.

X_1: Number of days discounted for low maximum temperature. Scored 1 day if maximum below 54 degrees; ⅗ of a day if 54 to 60; ⅕ of a day if 61 to 65. Surplus fractions omitted; i. e., 2⅘ equals 2.

X_2: Earliness adjustment; ¼ of a day added for each day full bloom occurred before April 16 average. Surplus fractions omitted; i. e., 2¾ equals 2.

X_{oe}: Historical average number of days from full bloom to first 25-car day.

Table 1 compares our method with the industry method of calculating the number of days from full bloom to the first carlot equivalent. The standard error of estimate (table 3) is 1.67 days using our method and 3.38 days using the industry method. Our method placed all 26 years within plus or minus 3 while the industry method fell within this range in only 17 years and exceeded 3 days in 9 years. Moreover, in 15 years our method was accurate within plus or minus 1 day compared with only 9 by the industry method.

Table 2 compares our method with the industry method of calculating the number of days from full bloom to the first 25-car day. The standard error of estimate (table 3) is 2 days using our method and 3.69 days using the industry method. Our method placed 25 of 26 years within plus or minus 3, with 21 of these within plus or minus 2. The industry method placed only 16 and 11 years, respectively, within these ranges. Only one error greater than 3 was realized using our method, whereas 10 of the industry forecasts exceeds 3.

It should be noted that in 1953, the year of greatest error in our method, the first 25-car day occurred extraordinarily early—on the day following the first carlot equivalent instead of the more usual 3 to 5 days later. This phenomenon lacks clear explanation but it has been established that unfavorable weather, which included rain, immediately preceded the first carlot equivalent shipment. Possibly this contributed to unusual distortion of the normal harvesting pattern.

Whether to use the first carlot equivalent or the first 25-car day depends primarily on the even-

tual use of the information. No doubt the first 25-car day better expresses volume shipping, but of greater consequence may be the ability of our first carlot calculation to fall more precisely within narrow limits.

Conclusions

Results suggest that the annual differences in elapsed time from full bloom to harvest are functions of low maximum temperatures experienced during the first 10 weeks of this period. Shipment forecasts are possible because maximum temperatures below the threshold value for peaches are unlikely to be experienced after June 30.

Our methods are significantly more accurate than the prevailing industry methods relative to both the first carlot equivalent and the first 25-car day. It is believed that their use could effect savings in time, dollars, and peace of mind, especially in years of unusually long or short periods from bloom to maturity.

Our methods were tested during the 1958 season with favorable results. Full bloom occurred on April 17 followed by 3 noncreditable days. Hence, 3 days added to the 119-day base for the first carlot equivalent and the 123-day base for the first 25-car day produced forecasts of August 17 and August 21, respectively. The first carlot equivalent was shipped on August 16, and August 20 was the first 25-car day. Both forecasts were only a day off the observed. What is more important, as early as mid-June the industry was warned of an impending early harvest and thus was prepared for it.

TABLE 3.—*Variance and standard error of estimate*

Method	First carlot equivalent F_1	First 25-car day F_{25}
Authors:		
Variance	2.80	4.00
Standard error of estimate	1.67	2.00
Industry:		
Variance	11.44	13.60
Standard error of estimate	3.38	3.69

F_1: 4.086. Significant.
F_{25}: 3.40. Significant.
Ratio of the variances according to the F table indicates a significant difference between the authors' method and the industry method of forecasting initial peach shipments from Mesa County, Colo. There is no significant difference in the ability to forecast the first carlot equivalent and the first 25-car day.

Comparative Efficiency of Farm Tenure Classes in the Combination of Resources

By Walter G. Miller

The extent to which the tenure status of farm operators affects agricultural efficiency has interested economists for decades. Different theories dealing with the subject have evolved; but only a few empirical studies have been made to test their validity. This deficiency in agricultural economics research arises, at least partly, from the need for techniques and procedures that will deal adequately with the problems involved. One purpose of the study on which this report is based was to explore methods that might be used in analyzing the inefficiencies that are due to tenure. The study was conducted under a cooperative arrangement between the Farm Economics Research Division, Agricultural Research Service, and the Agricultural Experiment Stations of Missouri, Iowa, Nebraska, and Kansas. The author acknowledges the contributions of the members of the North Central Land Tenure Research Committee to this article.

AMERICAN FARMERS are usually broadly classified as full owners, part owners, and tenants; tenants are subclassified according to the method of rental payment. Existing theories in tenure economics suggest that these tenure classes of farmers should differ as to efficiency in the use of farm resources (*11*, *10*, *3*, *8*).[1] The objective here was to examine the usefulness of least-squares estimating equations for comparing efficiency in the combination of resources within farms operated under different farm tenure classifications. The central hypothesis in this analysis of farm tenure classes was that tenure classes are different populations, with different patterns of resource allocation and levels of efficiency.

The Methods Used

The analysis rests heavily upon estimating equations of the Cobb-Douglas type.[2] These equations were fitted to cross-sectional data for the 1954 production year obtained from a sample of farms in Iowa and northern Illinois.[3]

A separate estimating equation was fitted to the data for each tenure class considered—full owners, livestock-share renters, and crop-share-cash renters.[4] The parameters and relationships derived for each tenure class were taken to represent those for the average farm within each group.[5] The estimating equations fitted are of the form

$$\hat{Y}=aX_1^{b_1}X_2^{b_2}X_3^{b_3}, \qquad (1)$$

in which, Y refers to gross production in dollars, and the resources, (the X's), are X_1—land investment in dollars, X_2—labor in weeks, and X_3—capital services in dollars. The b's are the estimated elasticities of production; that is, a 1-percent change in resource, X_i (i=1, 2, or 3) yields a change of b_i percent in production.

The data used yielded the production elasticities and other statistics shown in table 1. Except for the production elasticities of land and labor for

[1] Underlined numbers in parentheses refer to Literature Cited, page 15.

[2] This type of equation is used frequently in resource productivity studies but to a limited extent in the analysis of tenure-resource allocation problems (*4*).

[3] Because the data used were obtained by a stratified-random sample of farms, with different sampling proportions applied to each stratum, the functions were derived through weighted least squares.

[4] In order to reduce the confounding influence of age as it relates to the quality of labor and management, and to preferences, only the younger owners—those under 45 years of age—were examined because they are more comparable to tenants, who are predominantly the younger farmers. The numbers of observations were as follows: 51 full owners (under age 45), 78 livestock-share renters, and 75 crop-share-cash renters.

[5] The estimates obtained are not the true empirical counterparts of the theoretical concepts of intrafarm relationships; they are reasonable approximations from interfarm (cross-sectional) data.

TABLE 1.—*Parameters and related statistics of the estimating equation for each tenure class*

Tenure class	Regression constant (a)	Production elasticities [1]			Sum of elasticities (Σb_i)	Correlation index (R^2)
		Land (b_1)	Labor (b_2)	Capital services (b_3)		
Full owners	4. 0200	0. 0919 (. 06)	0. 1719 (. 12)	0. 7351 (. 07)	0. 9989	0. 76
Livestock-share renters	6. 4759	. 2315 (. 04)	. 1845 (. 08)	. 5330 (. 07)	. 9490	. 68
Crop-share-cash renters	3. 4166	. 2937 (. 04)	. 2472 (. 11)	. 4782 (. 07)	1. 0191	. 73

[1] The standard errors for the production elasticities are indicated, respectively, in parentheses below.

full owners, elasticities differ significantly from zero at probability levels of less than 10 percent. Estimates of elasticities of production that do not differ significantly from zero, are not, of course, plausible results. These occurrences may be accounted for by the general problem of intercorrelation that plagues regression analyses of this kind. Hence, the ensuing analysis based on these coefficients needs to be made with certain reservations.

Although the elasticities of production for land and labor for owners were nonsignificant at the more frequently acceptable levels of probability, the differences between tenure classes in the elasticities were tested. These tests were made in pairs. As shown in table 2, only 3 of the 9 pairs of differences tested differed significantly from zero at the 10 percent level of probability. The significant ones are (1) between full owners and the two tenant groups with respect to land and (2) between full owners and crop-share-cash renters with respect to capital services. None of the differences between the two tenant groups are significant. One might have expected to find more of the differences significant because of possible differences between tenure classes in scale of operation and combination of products.[6]

On the premise that the individual estimating equations represent the production functions which, along with the prices of productive factors, should guide decisions as to resource combinations, the analysis that follows seeks to estimate

[6] The differential effects of intercorrelation of the input categories and aggregation may also have affected the results obtained.

TABLE 2.—*Values of t for differences between tenure classes in production elasticities*

Tenure classes compared	Value of *t* for differences		
	Land	Labor	Capital services
Full owners vs. livestock-share renters	[1] 1. 99	[2] 0. 12	[2] 1. 50
Full owners vs. crop-share-cash renters	[3] 2. 68	[2] 0. 59	[4] 1. 86
Livestock-share vs. crop-share-cash renters	[2] 1. 08	[2] 0. 47	[2] 0. 57

[1] Significant at a probability level of 1 to 5 percent.
[2] Nonsignificant at probability levels of 10 percent and less.
[3] Significant at a probability level of 0.1 to 1 percent.
[4] Significant at a probability level of 5 to 10 percent.

the extent to which the optimum in the combination of resources is achieved under each tenure situation. Holding production fixed, the optimum (or the least-cost) combination of resources is determined by obtaining an equality of the ratios of the marginal return for each resource with the respective resource price.[7]

Using the basic estimating equation (1) for each tenure class, the equality to be achieved is

$$\frac{\partial \hat{Y}/\partial X_1}{P_1} = \frac{\partial \hat{Y}/\partial X_2}{P_2} = \frac{\partial \hat{Y}/\partial X_3}{P_3}, \qquad (2)$$

[7] Actually, opportunity costs are estimated and used instead of market factor prices. The solution used is analogous, however, to equating the marginal rates of substitution of resources with the inverse of the respective price ratios. The exceptions are that the value of production is used instead of physical production, and opportunity costs are used instead of actual factor prices.

in which production is held fixed at the geometric mean [8] for the respective tenure class.[9] That is, the marginal return-opportunity cost ratios are made equal for the resources—land, labor, and capital services. The values used for the opportunity costs are P_1 (land) = \$0.06 per dollar of land investment; P_2 (labor) = \$40 per week; and P_3 (capital) = \$1.10 per dollar, in which the extra dollar represents resources used up in the production process.

The solution yields the lowest possible costs for the given levels of production, granting the basic estimating equations and the price assumptions.[10] The calculated resource inputs associated with the optima are, more accurately, what the mean resource inputs, X_i, should have been to achieve the most efficient allocation of resources. The optimum quantities of each resource and the deviations of actual resource inputs from the optimum are shown in table 3.

Levels of Inefficiencies in Resource Combinations

According to table 3, livestock-share renters are the most efficient producers with total resource inputs used up of \$184, or 1.2 percent, more than the optimum. Full owners are the most inefficient when compared with tenant operators; their average excess of resource inputs over the minimum cost attainable is \$394, or 2.9 percent. Crop-share-cash renters are more like livestock-share renters. It is shown later that the small differences in average deviations, or levels of inefficiency, are not significant in a probability sense.[11] The expected differences could be reduced by possible errors in measurement.[12] Greater contrasts and variations in resource excesses and deficits are observed, however, through examination of the deviations with respect to each of the resource categories.

Full owners should have used less of both land and labor with more capital to achieve the optimum combinations. They show an excess (\$5,033, or 22.4 percent) in the amount of land needed to achieve their optimum and a deficit (\$1,031, or 10.4 percent) in capital services. Their greatest inefficiency was in the use of labor, which was 44 percent in excess of the optimum.[13] These results are in accord with economic reasoning: On the average, full owners should be limited in land, or capital services, or both, as compared with labor, because of capital rationing. Prior com-

[8] The geometric mean was used because the estimating equations were derived after logarithmic transformation of the variables. The arithmetic mean could have been used as well but would, of course, be subject to larger errors of the estimate.

[9] As $\partial\hat{Y}/\partial X_i = b_i\hat{Y}/X_i$, the equality to be achieved, in other terms, is

$$\frac{b_1\overline{Y}/X_1}{P_1} = \frac{b_2\overline{Y}/X_2}{P_2} = \frac{b_3\overline{Y}/X_3}{P_3} \qquad (1)$$

the unknowns being the values for X_i that represent the optimum quantities called X_i^*. The algebraic solution used was as follows. From equation (1) it follows that

$$X_1P_1b_2/P_2b_1 = X_2 = X_1', \text{ and} \qquad (2a)$$

$$X_1P_1b_3/P_3b_1 = X_3 = X_1''. \qquad (2b)$$

Substituting the left sides of equations (2a) and (2b), respectively, for X_2 and X_3 into the basic estimating equation expresses that equation in terms of X_1. Thus, with $\hat{Y} = \overline{Y}$, the estimating equation becomes

$$\overline{Y} = aX_1^{b_1}X_1'^{b_2}X_1''^{b_3}. \qquad (3)$$

Solve for X_1^* (the optimum quantity of X_1) in logarithms:

$$\log X_1^* = 1/\sum_{i=1}^{3} b_i \left[\log \overline{Y} - \log a - \sum_{j=2}^{3} b_j(\log P_1/P_j + \log b_j/b_1)\right]. \qquad (4)$$

The optimum quantities of X_2 and X_3 are obtained by substituting X_1^* into equations (2a) and (2b), respectively. That is

$$X_j^* = X_1^*P_1b_j/P_jb_1. \quad (j=2,3) \qquad (5)$$

[10] Logically, different prices will yield different optima.

[11] Interpreted in a different way: full owners are 97.1 percent, livestock-share renters 98.8 percent, and crop-share-cash renters 98.2 percent efficient. The differences between these "efficiency indices" are probably nonsignificant.

[12] For example, as the market values used for land inputs were obtained from tenants as well as owners, one can suspect subjective underestimation by tenants on the average.

[13] The excess labor for full owners can be identified, perhaps, with the general belief that "there is too much labor in agriculture." But it should be noted that, on the average, about 20 percent of the total labor reported is from the operator's family.

TABLE 3.—*Optimum resource combination, and deviations of actual resource combination from the optimum at the geometric mean of production for each tenure class*

Item	Resource combinations		Average deviation of actual from optimum combination	
	Actual	Optimum	Amount [1]	Percent
Full owners with production at $17,714:				
Land---dollars	27, 551	22, 518	+5, 033	+22. 4
Labor---weeks	91	63	+28	+44. 4
Capital services---dollars	8, 794	9, 825	−1, 031	−10. 4
Total value of productive services [2]---dollars	14, 087	13, 696	391	2. 9
Livestock-share renters with production at $22,936:				
Land---dollars	45, 884	65, 238	−19, 354	−29. 7
Labor---weeks	77	78	−1	−1. 3
Capital services---dollars	9, 566	8, 181	+1, 385	+12. 0
Total value of productive services [2]---dollars	15, 399	15, 215	184	1. 2
Crop-share-cash renters with production at $15,105:				
Land---dollars	41, 506	59, 389	−17, 883	−30. 1
Labor---weeks	76	75	+1	+1. 3
Capital services---dollars	6, 517	5, 274	+1, 243	+23. 6
Total value of productive services [2]---dollars	12, 047	11, 837	210	1. 8

[1] (+) indicates an excess (or greater than the optimum), and (−) indicates a deficit (or less than the optimum).
[2] Land services are valued at 6 percent of the total market value of land, and labor services at $40 per week.

mitments in land purchases may cause a restriction in the amount of other capital needed to operate most efficiently with a given quantity of labor.

The deviations from optimum resource combinations are similar for the tenant groups, with a minor exception: Crop-share-cash renters would require an additional week (or 1.3 percent) of labor while livestock share renters should have used a week less. This difference may be ignored. Hence the needed reorganization of resources for the tenants is predominantly the substitution of land for capital services. The less-than-optimum use of land may be associated partly with possible "undervaluation" of land input as noted earlier.[14]

[14] If the malallocations had been in terms of land-labor or labor-capital ratios, more plausible explanations could be advanced. For example, if the reorganization needed were the substitution of land for labor services, the inference could be drawn that landlords are in a better bargaining position than tenants. That is, landlords would be maximizing the marginal returns to land and minimizing the marginal returns to the tenants' contributions in labor. Or, if the malallocations were in terms of excess capital and deficit labor, the conclusion could be that a premium is placed on minimizing irksome farm operations or on leisure time. But, these ideas are not relevant in this instance.

However, there may still be a tendency under livestock-share leasing for landlords to "ration" land, choosing instead to furnish additional capital that is matched directly by tenants' capital under the terms of the usual livestock-share arrangements. If landlords provided more land, they would also need to provide more capital.

In the case of crop-share-cash leases, one might have supposed capital services to be limited in relation to land because of "imperfections" in cost-sharing arrangements. The improvements required in resource use would then be in favor of capital services instead of land. The results do not support these hypotheses. It is likely that restrictions in specific kinds of capital items are concealed by the aggregation of capital services. It may also be true that under conditions of a landlord rental market, landlords tend to allocate their land to tenants who have the largest amounts of capital available for the farm business.

Inasmuch as the directions of the resource malallocations observed do not differ between the tenant groups, the total value of productive services required at the optima for a similar level of production would vary between them (table 4). With the same production of $17,714, the average

TABLE 4.—*Resource quantities and total value of productive services required at the optima by each tenure class for a similar production level*

Tenure class	Production [1]	Resource requirements			Total value of services [2]
		Land	Labor	Capital services	
	Dollars	*Dollars*	*Weeks*	*Dollars*	*Dollars*
Full owners	17, 714	22, 518	63	9, 825	13, 696
Livestock-share renters	17, 714	49, 694	59	6, 233	11, 575
Crop-share-cash renters	17, 714	69, 423	88	6, 168	13, 853

[1] This level of production is that for the full owners.
[2] Productive services are valued as before.

livestock-share farm would use resources in the amount of $11,575. This is considerably less than the $13,853, required by the average crop-share-cash farm.

The total value of productive services required by the average crop-share-cash farm would be 19.7 percent greater than the amount required by the average livestock-share farm. Also, the amount required by the average owner-operator farm would be higher by 18.3 percent. When owner-operator farms are compared with crop-share-cash farms, the value of productive services is only 1.2 percent higher than that for the latter tenure class, a negligible difference.

The foregoing differences between the tenure classes in the total value of productive services required as well as the associated resource inputs are uniquely a function of the basic estimating equations representing each tenure class. The different estimating equations, in turn, cause differences in optimum resource requirements. To the extent that these differences are tenure-oriented and significant, it is presumed that the livestock-share lease encourages superior selection of enterprises or management.

Significance Tests for Inefficiencies in Resource Combinations

The significance of the deviations of actual resource inputs from the optimum inputs were first tested by comparing, statistically, the marginal rates of substitution of the resources at the geometric means with the inverses of the respective price ratios for the resources. Second, the differences in the absolute deviations (signs ignored) between these substitution rates and the respective price ratios were examined.[15]

From the basic estimating equation (1), the marginal rate at which resource X_j substitutes for X_i is defined as

$$\partial X_j/\partial X_i = b_i X_j/b_j X_i. \tag{3}$$

The well-known condition for the optimum combination of resources is that the marginal rate at which one resource substitutes for another must be equal to the inverse of the ratio of prices for the respective resources. It follows from equation (2) that this condition can be expressed as

$$b_i X_j/b_j X_i = P_i/P_j \tag{4}$$

for all possible pairs of resources. P_i and P_j are, respectively, the prices of the resources X_i and X_j. It can be shown that at the optimum values (X_i^*) determined for each resource, the marginal rates of substitution of the resources are identical to the inverses of the price ratios. That is,

$$b_i X_j^*/b_j X_i^* = P_i/P_j. \tag{5}$$

Thus the deviations of the marginal rates of substitution of resources at the geometric means from the inverse of the respective price ratios were used as a means of testing for inefficiencies in the combination of resources. The test variable becomes

$$d_{j,i} = b_i \bar{X}_j/b_j \bar{X}_i - P_i/P_j. \tag{6}$$

The marginal rate at which resources substitute at the geometric means are shown in table 5. In

[15] The author is indebted to Dr. C. B. Baker of the University of Illinois for suggesting these procedures.

the case of full owners, for example, $566 of land substitute for 1 week of labor; and ignoring the sign, the deviation from the respective price ratio is $100 of land for a week of labor. The other rates are interpreted according to the units indicated by the table.

From the estimates presented in table 5, most of the deviations are not highly significant.[16] The significant differences are in the deviations of the land-capital substitution rates for both classes of tenants. These are significant at a probability level of 1.0 percent.[17]

Although resource excesses and deficits (table 3) were observed for full owners, this test failed to show significant inefficiencies in resource combinations. This occurrence is related, at least partly, to the relatively larger variances of the marginal rates of substitution for owners.

As mentioned earlier, the significance of the differences between tenure classes in the deviations of marginal rates of substitution from the respective price ratios were tested also.[18]

[16] The hypothesis is that the deviation, $d_{i.i}$, is equal to zero. The test employed is

$$t=\frac{b_i\overline{X}_j/b_j\overline{X}_i-P_i/P_j}{s(B_{j.i})},$$

in which $s(B_{j.i})$ is the standard error of the marginal rate of substitution $(b_i\overline{X}/b_i\overline{X}_i)$ obtained from the variance formula:

$$V(B_{j.i})\doteq\left(\frac{b_i\overline{X}_j}{b_i\overline{X}_i}\right)^2\left(\frac{s^2_{b_i}}{b_i^2}+\frac{s^2_{b_j}}{b_j^2}-2r_{ij}.\frac{s_{b_i}s_{b_j}}{b_i\,b_j}\right).$$

[17] The fact that there are resource malallocations in terms of land-capital combinations for the tenants was further revealed by testing the differences between resource marginal returns at the geometric means and those at the optimum. The statistic used was

$$t=\frac{M_{i.g}-M_{i.opt}}{s(m_{i.g})},$$

in which $M_{i.g}$ and $M_{i.opt}$ are, respectively, the marginal returns to resource X_i (i. e., $b_i\overline{Y}/X_i$) at the geometric mean and its optimum; and $s(m_{i.g})$ is the standard error of $M_{i.g}$.

[18] The test used was

$$t=\frac{d_{j.ik}-d_{j.il}}{s(d_{j.ik}-d_{j.il})},$$

in which $d_{j.i}$ denotes the deviation of the marginal rate of substitution of resource X_j for X_i from the inverse of the respective ratio of prices (table 5). The subscripts, k and l, are the tenure classes compared; and $s(d_{j.ik}-d_{j.il})$ is the standard error of the difference in deviations.

$$s(d_{j.ik}-d_{j.il})=\sqrt{V(d_{j.ik})+V(d_{j.il})};$$

and

$$V(d_{j.i})\doteq d^2_{j.i}\left(\frac{s^2_{b_i}}{b_i^2}+\frac{s^2_{b_j}}{b_j^2}-2r_{ij}.\frac{s_{b_i}s_{b_j}}{b_ib_j}\right),$$

in which

$$d_{ij.}=b_i\overline{X}_j/b_i\overline{X}_i-P_i/P_j.$$

TABLE 5.—*Marginal rates of substitution of resources at the geometric means by tenure classes and their deviations from the inverses of the respective resource price ratios*

Tenure class	Land for labor	Capital for labor	Land for capital
	MARGINAL RATE OF SUBSTITUTION		
	$/wk	$/wk	$/$
Full owners	566	23	25
Livestock-share renters	475	43	11
Crop-share-cash renters	460	44	10
	ALGEBRAIC DEVIATIONS OF INVERSE OF PRICE RATIO FROM MARGINAL RATE OF SUBSTITUTION [1]		
Full owners	−100	−13	7
Livestock-share renters	−191	7	−7
Crop-share-cash renters	−206	8	−8
	VALUE OF T FOR DIFFERENCE BETWEEN MARGINAL RATE OF SUBSTITUTION AND INVERSE OF PRICE RATIO		
Full owners	0. 18	0. 81	0. 39
Livestock-share renters	0. 89	0. 37	[2] 3. 50
Crop-share-cash renters	0. 93	0. 36	[3] 2. 67

[1] A deviation is the difference between the marginal rate of substitution and the inverse of the price ratio, that is, $d_{i.i}=B_{j.i}-P_{i.j}$ prices assumed are as before, and the inverses of the price ratios of concern here are rounded as follows: Labor/land=666; Labor/capital=36; Capital/land=18.

[2] Significant at a probability level of 0.1 percent.

[3] Significant at a probability level of 1.0 percent. Other values of t are not significant at probability levels of 30 percent or less.

The results in table 6 show that for the values of t obtained, none of the observed differences in deviations are statistically significant at usually accepted probability levels. These findings imply that the differences between tenure classes in the average deviations of actual total costs of productive services from the minimum costs attainable,

that is, in the overall inefficiencies (table 2), are not significant in a probability sense.

TABLE 6.—*Values of t for differences between tenure classes in the absolute deviations of marginal rates of substitution from the inverses of the respective price ratios* [1]

Tenure classes compared	Values of t for differences in deviations		
	Land-labor substitution	Capital-labor substitution	Land-capital substitution
Full owners vs. livestock-share renters	0. 69	0. 32	0. 00
Full owners vs. crop-share-cash renters	0. 52	0. 51	0. 20
Livestock-share renters vs. crop-share-cash renters	0. 87	0. 20	0. 40

[1] The deviations were shown in table 4.

TABLE 7.—*Marginal returns to resources and marginal return-opportunity cost ratios by tenure classes and value of t for differences of the ratios from unity*

MARGINAL RETURNS AT THE GEOMETRIC MEANS

Tenure class	Land	Labor	Capital services
	$/$	*$/wk*	*$/$*
Full owners	0. 059	33. 50	1. 480
Livestock-share renters	0. 116	54. 79	1. 278
Crop-share-cash renters	0. 107	48. 98	1. 108
MARGINAL RETURN-OPPORTUNITY COST RATIO [1]			
Full owners	0. 98	0. 84	1. 35
Livestock-share renters	1. 93	1. 36	1. 16
Crop-share-cash renters	1. 78	1. 23	1. 01
VALUES OF T FOR DIFFERENCES OF THE RATIOS FROM UNITY			
Full owners	[2] 0. 03	[2] 0. 28	[3] 2. 33
Livestock-share renters	[4] 2. 69	[2] 0. 64	[2] 1. 07
Crop-share-cash renters	[4] 2. 99	[2] 0. 42	[2] 0. 06

[1] The opportunity costs assumed are as before: 6 percent per year for land, $40 per week for labor, and 10 percent per year for capital services.
[2] Nonsignificant at probability levels of 10 percent and less.
[3] Significant at a probability level of 1 to 5 percent.
[4] Significant at a probability level less than 1 percent.

Other Indicators of Inefficiencies

Using the basic estimating equation (1) and the resource prices, the optimum quanities of resources as well as output are achieved if

$$\frac{\partial \hat{Y}/\partial X_1}{P_1}=\frac{\partial \hat{Y}/\partial X_2}{P_2}=\frac{\partial \hat{Y}/\partial X_3}{P_3}=1 \qquad (7)$$

Both output (Y) and the resource categories (X_1) become variables subject to expansion or contraction, and marginal returns are equated with the respective resource prices. But under the phenomenon of increasing or constant returns to scale, the optimum output and the associated resource requirements would become infinitely large or indeterminate if all the variables were allowed to change simultaneously. Consequently, under these situations, attempts to estimate levels of efficiency with production permitted to vary may not yield plausible results.[19] Clues to inefficiencies, however, may be obtained by comparing the levels of marginal returns for different resources with the respective resource prices.

Departures of marginal returns from the prices (or opportunity costs) of the respective resources yielding the returns, are evidences of inefficiencies in some instances.[20] Estimates of the magnitudes of the departures serve as clues to the extent of the inefficiencies. But, in addition to the customary type of analysis, these estimates were tested for statistical significance, in order to estab-

[19] To obtain a plausible optimum, "decreasing returns to scale" is necessary. For practical purposes, this phenomenon is observed for livestock-share renters only—the sum of the production elasticities is less than one. However, some resources can be reasonably varied, holding others fixed, provided that the sum of the "variable" resources is also less than one. But the optimum solutions obtained would then be more analogous to the types needed for the "short-run," and these are not of concern here. But even at that, caution should be exercised in making estimates of this kind, as predictions removed from the means (geometric in this case) are subject to larger standard errors, and there is a possibility of extrapolation.

[20] If the return to a resource at the margin is greater than the resource price, it means that the use of the resource could be extended profitably. If the return is less than the resource price, it means one of 3 things: (1) that some other resource is limitational, (2) that the resource in question is used in excess of the optimum quantity, or (3) both.

lish some confidence as to the nature of resource readjustments that should take place.[21]

Marginal returns (table 7) are the additional returns per unit of input if one more unit of the resource is added at the geometric means. The rather high marginal return of 48.0 percent to capital services for full owners suggests that, on the average, capital is the limiting resource for them: The difference between this marginal return and the opportunity cost is significant at the 5-percent probability level, while the differences for the other resources are not significant.

In order to increase net returns, the use of capital could be extended until its marginal return equals (or approaches) the opportunity cost of 10 percent. With an increase in the use of capital, the marginal productivities of both land and labor that are now below their opportunity costs of 6 percent and $40 per week, respectively, would be increased.

Superficially, land appears to be slightly in excess for full owners. However, as the marginal return is not significantly below 6 percent one might conclude that capital rationing operates more to limit the use of capital services rather than to limit the use of land. In essence, the findings further support the hypothesis that prior commitments to land purchases force restrictions in the use of nonland capital.

Unlike full owners, all the marginal returns for the tenant classes are above the opportunity costs of the resources. It means that the use of all the resources might be extended profitably. But land appears to be the only "limitational" resource: The differences between the marginal returns to land and its opportunity cost are significant at the 1-percent probability level (table 7). Therefore, for the firm, the quantity of land should be extended.[22]

The levels of marginal returns to capital services and labor for the tenant classes could logically be expected. They are not significantly above the opportunity costs. Presumably, one reason for this is the joint contribution of landlords and tenants to the total farm assets, coupled with the sharing of risks of larger scale operations. The higher marginal return to labor for the tenants is indirectly a function of the greater amount of farm assets used in combination with labor.

Notably, all the marginal returns under crop-share-cash renting are lower than those under livestock-share renting. This situation could be related to (1) superior management on the livestock-share farms or (2) different combination of enterprises, or (3) both. These inferences are based primarily on the larger regression constant observed for the livestock-share renters (table 1). Put in another way: the estimate of a marginal return depends also upon the height of a marginal productivity curve, which is a function of a constant. The regression constant is one of the parameters that define the constant associated with the marginal productivity curve. Differences in the size of the constant could be due to differences in management or enterprise combinations.

Some Implications for Further Research

The level of inefficiency, in terms of resource combinations, under each tenure class appears to be unimportant because the average reductions in costs, especially percentagewise, are small and do not differ significantly between the tenure classes. These observations then introduce the possibility that either no real economic problems exist for the broad tenure classes or the methods used are inadequate for detecting the inefficiencies present. On the one hand, it could be argued that the differences are hidden by the aggregative nature of the analytical model. On the other, within the

[21] The t test was applied. That is

$$t=\frac{M_i-P_i}{s(m_i)},$$

in which M_i is the marginal return $(b_i\bar{Y}/\bar{X}_i)$ to resource, X_i; P_i is the opportunity cost of the respective resource; and $s(m_i)$ is the standard error of the marginal return.

$$s(m_i)=\sqrt{A^2\frac{1}{n}\left(s_y\frac{b_i\bar{Y}}{\bar{X}_i}\right)^2-c_{ii}\left(s_y\frac{\bar{Y}}{X_i}\right)^2}.$$

The factor A is the adjustment for logarithmic transformation taken to the base 10; c_{ii} denotes the diagonal element for the variable X_i in the variance-covariance matrix. (The variance formula used was obtained from an unpublished manuscript by H. O. Carter and H. O. Hartley of Iowa State College entitled, "A Variance Formula for Marginal Productivity Estimates Using the Cobb-Douglas Function.")

[22] As mentioned previously, a part of this shortage in land could stem from the "undervaluation" of land, as dollar input, by the tenants.

broad tenure classes the heterogeneity of tenure arrangements (*5*) could have canceled the inefficiencies (if any) present.[23] Therefore, both facets of the problem require further inquiry.

The differences in the patterns of deviations (resource excesses and deficits) from the optimum resource combinations by tenure classes, however, suggest that each tenure class represents a different "problem situation" for further inquiry as the causes for deviations from the optima conceivably vary according to tenure status. Furthermore, for a similar production level, the average livestock-share farms had the lowest total resource requirement. Presumably, this was due partly to different management and combinations of products.

Limitations of the Equation Model

Functions of the Cobb-Douglas type have certain weaknesses that limit their use but do not preclude them as tools for further research. They still have certain advantages over other types of functions (*12*), and may be useful under given situations if they are used cautiously.

One source of difficulty is the aggregation of products and factors (*9*). Because of the kind of data available, the output variable was aggregated to total production, although it was recognized that certain biases may stem from such aggregation. This question, however, is particularly relevant if it is true that "imperfections" in leasing cause deviations from optimum combination of enterprises. The value of production from a given stock of resources is reduced accordingly; therefore the effects of product combination may be reflected in the coefficients of the estimating equations.

Different functions for crops and livestock would reduce the biases that may arise but would not eliminate them, as crop combinations and livestock combinations may also differ between tenure classes. That is, apart from differentials in price effects, the physical responses of different products to similar resources are not the same. For multiple-product firms, a certain level of aggregation is necessary. Adequate information on the division of resources between crops and between kinds of livestock usually is not available from cross-section samples of farms (*1*).

The aggregation of factors of production into resource categories presents another weakness. Productivity estimates of a resource may be expected to change if the categories of other resource inputs are altered. That is, the differences between tenure classes in the use of land or labor need not be the same if capital services are broken down further.[24] Lumping of capital services, however, conceals the way in which more specific capital items are used. Inefficiencies in the use of such items as fertilizer and other variable productive services would be necessary in a rigorous analysis.

The exclusion of management as a factor may pose another limitation. Unless management is uniform between tenure groups in the universe, differences in the estimating equations will not be explained completely. Further, if management happens to be intercorrelated with any other resource category for any particular tenure group, its effects are likely to cause overestimation of the production elasticity of the resource with which it is positively correlated (*7, pp. 16-23; 2*). This problem is only a special case of the general problem of intercorrelation which affects regression analysis adversely.

The question of intercorrelation is of concern also in analysis of labor productivity. With a relatively small variation in labor inputs in a sample of farms (owing partly, perhaps, to weaknesses in measurements) labor productivity may be underestimated through biases in the regression coefficients. But an attempt can be made to reduce these biases by purposive or stratified sampling.

Further Application of the Methods Used

The crucial observation made in the study reported here invites serious doubts as to whether the traditional tenure classes studied—full owners and full tenants—differ in the aggregate with respect to the level of efficiency achieved in terms of resource combinations. Even with refinements of the methods used, it is suspected that further analysis of these classes would not show meaning-

[23] D. Gale Johnson has observed that "* * * the nature of deviations from optimum [resource allocation] are quite subtle and not immediately obvious from a cursory examination of American farms operating under different types of tenure arrangements (*6, p. 114*)."

[24] Certain guidelines in the aggregation of factors are available (*9*).

ful differences. If differences were observed, the specific causes would not be identified. As the small values obtained for deviations from optimum resource combinations suggest that the inefficiencies of individual observations may be canceled by the efficiencies of other individual observations, it is implied that analytical models should be oriented toward isolation of the specific arrangements of tenure that may be impediments to production efficiency.

Removing the effects of some factors that are not directly associated with tenure per se is necessary. An attempt was made to do so by considering only the younger owners for comparative purposes. Theoretically, factors such as quality of labor, managerial ability, capital position of the firm, and work preferences affect resource use and productivity estimates and are important to the extent that they are functionally related to the age of farm operators. Further adjustments for "age effects" should therefore be considered.

Still it is not apparent that the effects of specific tenure characteristics can be so easily isolated even within more comparable tenure-age groups because different tenure arrangements may generate forces going in opposite directions. For example, the incentives of a financially encumbered full owner need not be the same as those of an unencumbered owner. Also, the effects of nonoptimum cost-sharing arrangements may be offset by the sharing of uncertainties under share leases. Thus the results may remain confounded. It is then suggested that further analysis that attempts to isolate the effects of tenure arrangements should focus attention on the specific tenure arrangements themselves, using the conventional tenure classification only as an initial device. If estimating equations are used for this purpose, they would of necessity entail a relatively large sample of each tenure class that could be broken down into "cells" of adequate sizes, based on the tenure arrangements to be controlled.

Despite the possible weaknesses of the basic estimating equation model, it would appear that the procedures as presented in this paper and as refined could be extended usefully to the analysis of efficiency within other statistical populations of agricultural firms. It will not displace other methods such as the use of cost curves, but the analysis will be less partial in that it considers the use of all resources simultaneously. Nor will it replace the use of analysis of variance or covariance models; they provide different kinds of information and could well be used as complements.

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Factors Affecting Prices of Pears

By Ben H. Pubols

What makes the price of a particular crop of pears and why prices tend to change from year to year are questions of special concern to growers, processors, and others interested in the production, marketing, and pricing of pears. The market structure for pears, as for other fruits, is a complex one, and throughout the marketing season, various forces exert their influence upon the season average price received by growers. Statistical data representing all of the price making factors for any particular crop are not available but, for a large number of agricultural commodities, the size of production and stocks, the level of national income, and the production of closely competing commodities are usually of considerable importance. In this study, an attempt has been made to measure the influence of these factors on prices of all West Coast pears, all Pacific Coast Bartlett pears sold for fresh use, Bartletts sold for canning, Pacific Coast pears other than Bartletts, and pears other than those grown on the Pacific Coast. Although these factors do not account for all price changes, they do explain a rather considerable amount of variation in the prices received. It is hoped that measurements of the price making influence of some of the excluded factors can eventually be made.

OF THE VARIOUS DECIDUOUS and citrus fruit crops, pears have ranked fifth in value of production in recent years. The 1957 pear crop of about 32 million bushels was valued at nearly $63 million. About 90 percent of this crop was grown in the Pacific Coast States of California, Oregon, and Washington, where production has trended upward in contrast to a decline in other States.

In these 3 States, about 75 percent of the annual production consists of Bartlett pears, and the rest of fall and winter varieties, of which the D'Anjou leads. In the other 22 States for which data are available, production consists also of a number of varieties including the Bartlett. But separate figures by varieties are not available. Most of these States are in the eastern half of the United States.

Utilization of pears as between fresh use and use for processing varies considerably by varieties and to some extent by location of production. In recent years, from 65 to 75 percent of the Pacific Coast Bartlett crop has been processed, chiefly by canning. Most of the rest was sold for fresh use, and a relatively small quantity was used in the households of the farmers who grew them. Fresh market sales were heaviest from July through December, with only relatively minor quantities shipped after January 1.

In contrast, over the same years, from about 18 to 23 percent of the Pacific Coast pear crop other than Bartlett was processed, also chiefly by

TABLE 1.—*Pears, all Pacific Coast: Effect on year-to-year changes in price received by growers of year-to-year changes in specified factors, 1925–54*

Item	Unit	1925–42	1942–54	1925–54
Coefficient of multiple determination		0. 91	0. 91	0. 86
Standard error of estimate		. 06	. 06	. 07
Constant "a" or intercept value		. 012	−0. 062	−0. 004
Effect on price of a 1-percent change in—				
(1) Total production of Pacific Coast pears:				
Net effect	Percent	−1. 50	−1. 52	−1. 49
Standard error	do	. 22	. 51	. 20
Coefficient of partial determination		. 80	. 56	. 70
(2) Disposable personal income:				
Net effect	Percent	1. 75	3. 19	1. 80
Standard error	do	. 28	1. 42	. 30
Coefficient of partial determination		. 77	. 42	. 61
(3) Stocks of canned pears, June 1:				
Net effect	Percent	−0. 11	−0. 33	−0. 14
Standard error	do	. 04	. 09	. 04
Coefficient of partial determination		. 37	. 68	. 35
(4) Production of pears other than Pacific Coast:				
Net effect	Percent	[1] . 01	[1] −0. 20	[1] −0. 10
Standard error	do	. 16	. 13	. 10
Coefficient of partial determination		. 00	. 27	. 04

[1] Does not differ significantly from zero at the 5-percent level of probability.

canning. The Hardy variety grown in California accounted for most of the canned pears other than Bartlett; they were used largely as an ingredient of fruit cocktail. Of the remaining varieties of fall and winter pears, some were used in the households of farms where grown. But most of them were sold for fresh use. Although some of these pears were shipped as soon as harvested, the greater part of the crop was put into cold storage, from which sales were made during fall, winter, and spring. These pears comprised most of the total of all varieties sold after January 1.

In States other than the three on the Pacific Coast, especially in the eastern and central States, fresh sales usually amounted to less than half of the crop and use in households of farms where grown took most of the rest. Although usually only a small percentage of the production was processed, this percentage apparently has increased somewhat in recent years. Usually, of the pears placed in cold storage for fresh market sale, relatively few remained for shipment after January 1.

Data and Method

THIS description of the production, utilization, and marketing of pears indicates important differences in the pear industry, which logically would have a bearing on price. Perhaps the most important differences relate to and are outgrowths of variety and location of production. For these reasons, separate series on production by variety and geographic area were used in the analyses.

These series are (1) all Pacific Coast pears, (2) Pacific Coast Bartletts, (3) Pacific Coast pears other than Bartlett, and (4) pears other than Pacific Coast. Other series used in the analyses were those showing stocks of canned pears held by packers and disposable personal income of consumers. Exploratory work pointed to production, stocks, and income as the three factors of ranking importance in effects on prices, hence their use as independent factors.

Beginning with those for 1925, the basic statistics used in the study are principally from data prepared and published by the United States Department of Agriculture. Figures on prices for pears relate to season-average prices received by growers for the annual crops. Data on production relate to final estimates for the crops and hence do not involve early-season estimates. Figures on stocks of canned pears held by packers are given as of June 1, a date near the beginning of the new pack season. Data depicting disposable personal income relate to income for July to December in terms of annual rates. All series on production, stocks of canned pears, and personal

TABLE 2.—*Pears, Pacific Coast Bartlett, fresh: Effect on year-to-year changes in price received by growers of year-to-year changes in specified factors, 1925–54*

Item	Unit	1925–42	1942–54	1925–54
Coefficient of multiple determination		0. 83	0. 89	0. 78
Standard error of estimate		. 13	. 09	. 13
Constant "a" or intercept value		. 032	−0. 049	0. 004
Effect on price of a 1-percent change in—				
(1) Total production of Pacific Coast Bartletts:				
Net effect	Percent	[1] −0. 98	−1. 83	−1. 44
Standard error	do	. 72	. 61	. 41
Coefficient of partial determination		. 14	. 56	. 34
(2) Disposable personal income:				
Net effect	Percent	2. 12	[1] 2. 93	2. 24
Standard error	do	. 67	2. 07	. 57
Coefficient of partial determination		. 47	. 22	. 40
(3) Stocks of canned pears:				
Net effect	Percent	[1] −0. 17	−0. 54	−0. 22
Standard error	do	. 09	. 13	. 07
Coefficient of partial determination		. 26	. 71	. 31
(4) Production of Pacific Coast pears other than Bartlett:				
Net effect	Percent	[1] −1. 05	−0. 97	[1] −0. 69
Standard error	do	. 57	. 39	. 34
Coefficient of partial determination		. 24	. 47	. 15

[1] Does not differ significantly from zero at the 5-percent level of probability.

income are adjusted for population to allow for an increase in number of people, that is, they are put on a per capita or per 1,000 basis.

After the adjustments for population as noted, the statistical series were converted to first differences of logarithms for purposes of correlation analysis. Use of first differences (year-to-year changes in the data) tends to reduce or eliminate distortions that are due to trends or cycles. Use of logarithms implies that relationships among the variables are proportional rather than absolute.

To measure relationships among variables, the least-squares, single-equation correlation method was used. This method assumes that the independent variables in each of the analyses are determined by factors other than the dependent variable. The results obtained indicate that this method constitutes a good first approach to the solution of the problem, even though somewhat different results probably would be obtained by some other method, such as simultaneous equation techniques.

Five Pear Situations Analyzed

In the study of pear prices and related factors reported in this article, the following five situations were analyzed:

1. Prices of all Pacific Coast pears as related to production of all Pacific Coast pears, diposable personal income, stocks of canned pears, and production of pears other than Pacific Coast.

2. Prices of Pacific Coast Bartlett pears sold for fresh use as related to total production of Pacific Coast Bartlett pears, disposable personal income, stocks of canned pears, and production of Pacific Coast pears other than Bartlett.

3. Prices of Pacific Coast Bartlett pears sold for canning as related to total production of Pacific Coast Bartletts, disposable personal income, stocks of canned pears, and production of Pacific Coast pears other than Bartlett.

4. Prices of Pacific Coast pears other than Bartlett as related to production of Pacific Coast pears other than Bartlett, disposable personal income, total production of Pacific Coast Bartletts, and production of pears other than Pacific Coast.

5. Prices of pears other than Pacific Coast as related to production of pears other than Pacific Coast, disposable personal income, and production of all Pacific Coast pears.

These five situations were analyzed for 1925–42, 1942–54, and for both periods combined. The World War II years were included in the study, because price movement probably was limited little if any by price ceilings, which were set at the higher levels reached after much of the rise had occurred.

TABLE 3.—*Pears, Pacific Coast Bartlett, canned: Effect on year-to-year changes in price received by growers of year-to-year changes in specified factors, 1925–54*

Item	Unit	1925–42	1942–54	1925–54
Coefficient of multiple determination		0.81	0.94	0.71
Standard error of estimate		.12	.08	.14
Constant "a" or intercept value		.019	−0.074	−0.009
Effect on price of a 1-percent change in—				
(1) Total production of Pacific Coast Bartletts:				
Net effect	Percent	[1] .16	−2.22	−1.28
Standard error	do	.61	.50	.45
Coefficient of partial determination		.01	.74	.26
(2) Disposable personal income:				
Net effect	Percent	1.93	4.03	2.39
Standard error	do	.52	1.71	.57
Coefficient of partial determination		.54	.44	.42
(3) Stocks of canned pears:				
Net effect	Percent	−0.19	−0.62	−0.24
Standard error	do	.07	.11	.08
Coefficient of partial determination		.36	.82	.29
(4) Production of Pacific Coast pears other than Bartlett:				
Net effect	Percent	−1.18	−0.67	[1] −0.34
Standard error	do	.48	.31	.36
Coefficient of partial determination		.33	.40	.04

[1] Does not differ significantly from zero at the 5-percent level of probability.

Results of the correlation analyses for the five situations are summarized in tables 1 to 5, and they are described in the sections that follow:

1. *Prices of all Pacific Coast pears.*—In this situation, about 91 percent of the year-to-year changes in season-average prices received by growers for all Pacific Coast pears were associated with year-to-year changes in total production of Pacific Coast pears, disposable personal income, stocks of canned pears, and production of pears other than Pacific Coast, for 1925–42 and 1942–54 separately (table 1). For both periods combined, the percentage dropped to 86.

The effect of the individual independent factors on price varied considerably. On the average, after allowing for the effects of income, stocks, and "other" production, a 1-percent change in production of all Pacific Coast pears was associated with about a 1.5 percent change in the opposite direction in the price of all Pacific Coast pears, for the three periods analyzed. Similarly, a 1-percent change in income was associated with a net change in the same direction of about 1.8 percent in price for 1925–42, 3.2 percent for 1942–54, and 1.8 percent for both periods combined. The larger income coefficient obtained from the recent period partly reflects the change in price level.

The relation of stocks of canned pears to price, except for 1942–54, was not as close as that of production or income, as indicated by the coefficients of partial determination. The effects on price of production of Pacific Coast pears, income, and stocks are in line with expectations. Production of pears other than Pacific Coast shows relatively little or no significant relation to price of Pacific Coast pears. This also is in line with what might logically be expected, as the other pears are used mainly in the localities grown and hence compete very little with Pacific Coast pears. Moreover, they comprise only about 10 percent of the annual production of pears.

The regression equation for the analysis of prices for all Pacific Coast pears for 1925–54, when all variables are expressed as first differences of logarithms, is as follows:

$$X' = -0.004 - 1.49X_2 + 1.80X_3 - 0.14X_4 - 0.10X_5$$
$$\qquad\qquad (0.20)\quad (0.30)\quad (0.04)\quad (0.10)$$

in which X' is the estimated season-average price received by growers for all Pacific Coast pears, X_2 is total production of Pacific Coast pears per 1,000 persons, X_3 is disposable personal income per capita, X_4 is packers' stocks of canned pears per 1,000 persons, and X_5 is production of pears other than Pacific Coast per 1,000 persons. The influence on price of the latter (X_5) is small and statistically not significant. The numbers in parentheses indicate the standard errors of the

TABLE 4.—*Pears, Pacific Coast, other than Bartlett: Effect on year-to-year changes in price received by growers of year-to-year changes in specified factors, 1925–54*

Item	Unit	1925–42	1942–54	1925–54
Coefficient of multiple determination		0. 86	0. 72	0. 71
Standard error of estimate		. 07	. 06	. 08
Constant "a" or intercept value		. 001	−0. 069	−0. 011
Effect on price of a 1-percent change in—				
(1) Production of Pacific Coast pears other than Bartlett:				
Net effect	Percent	[1] −0. 46	[1] −0. 27	−0. 64
Standard error	do	. 31	. 31	. 22
Coefficient of partial determination		. 15	. 10	. 26
(2) Disposable personal income:				
Net effect	Percent	1. 59	3. 24	1. 43
Standard error	do	. 32	1. 43	. 34
Coefficient of partial determination		. 67	. 42	. 42
(3) Production of Pacific Coast Bartletts:				
Net effect	Percent	−0. 96	[1] 0. 67	[1] −0. 29
Standard error	do	. 40	. 39	. 27
Coefficient of partial determination		. 32	. 29	. 05
(4) Production of pears other than Pacific Coast:				
Net effect	Percent	[1] −0. 25	−0. 35	[1] −0. 18
Standard error	do	. 19	. 15	. 12
Coefficient of partial determination		. 12	. 46	. 09

[1] Does not differ significantly from zero at the 5-percent level of probability.

respective regression coefficients. All numbers for this equation are from the last column of table 1. Similar regression equations for 1925–42 and 1942–54 of this price situation and for all periods of the other four situations may be constructed from the appropriate figures of tables 1 to 5.

The results of the analysis for prices of all Pacific Coast pears for 1925–54 as given in the equation and applied to data for 1955 indicated a price of $2.16 per bushel. The actual price was $2.15. For 1956, the results indicated a price of $2.05. The actual price was $2.31, about 13 percent higher than calculated. The price for all Pacific Coast pears covers pears for fresh use, canning, and other processing.

2. *Prices of Pacific Coast Bartlett pears sold for fresh use.*—Year-to-year changes in season-average price received by growers for Pacific Coast Bartlett pears sold for fresh use were associated with year-to-year changes in total production of Pacific Coast Bartlett pears, disposable personal income, stocks of canned pears, and production of Pacific Coast pears other than Bartlett to the extent of 83 percent for 1925–42, 89 percent for 1942–54, and 78 percent for 1925–54 (table 2).

As with other classes of pears, the individual factors varied considerably from one time period to another in their influence on price. On the average and after allowing for the effect of other variables, a 1-percent change in total production of Pacific Coast Bartletts was associated with a change in price in the opposite direction of 1 percent for 1925–42, 1.8 percent for 1942–54, and 1.4 percent for both periods combined. The effect of income on price, but in the same direction, was much stronger. The effects on price of stocks of canned pears and of production of Pacific Coast pears other than Bartlett were generally not as strong as those of production of Bartletts and income.

3. *Prices of Pacific Coast Bartlett pears sold for canning.*—For the period 1942-54, about 94 percent of the year-to-year changes in prices received by growers for Pacific Coast Bartlett pears sold for canning were explained by year-to-year changes in total production of Pacific Coast Bartletts, disposable personal income, stocks of canned pears, and production of Pacific Coast pears other than Bartlett (table 3). For 1925–42, about 81 percent of the changes in prices were explained by the same factors, and for both periods combined about 71 percent were so explained.

Production of Pacific Coast Bartletts and income influenced price strongly from 1942 to 1954; and from 1925 to 1954, the influence of these two factors was fairly strong. The influence of production on price was statistically not significant

TABLE 5.—*Pears, other than Pacific Coast: Effect on year-to-year changes in price received by growers of year-to-year changes in specified factors, 1925–54*

Item	Unit	1925–42	1942–54	1925–54
Coefficient of multiple determination		0. 78	0. 83	0. 78
Standard error of estimate		. 05	. 06	. 06
Constant "a" or intercept value		−0. 020	−0. 066	−0. 022
Effect on price of a 1-percent change in—				
(1) Production of pears other than Pacific Coast:				
Net effect	Percent	−0. 74	−0. 71	−0. 65
Standard error	do	. 13	. 12	. 08
Coefficient of partial determination		. 71	. 80	. 73
(2) Disposable personal income:				
Net effect	Percent	1. 07	3. 28	1. 12
Standard error	do	. 23	1. 39	. 23
Coefficient of partial determination		. 63	. 41	. 48
(3) Total production of Pacific Coast pears:				
Net effect	Percent	[1] −0. 01	[1] 0. 69	[1] 0. 06
Standard error	do	. 18	. 45	. 16
Coefficient of partial determination		. 00	. 23	. 01

[1] Does not differ significantly from zero at the 5-percent level of probability.

for 1925–42. Likewise, the influence on price of production of Pacific Coast pears other than Bartlett was statistically not significant for 1925–54. The effect of stocks of canned pears was especially strong for 1942–54, when the percentage of the crop canned rose sharply.

4. *Prices of Pacific Coast pears other than Bartlett.*—Year-to-year changes in prices received by growers for Pacific Coast pears other than Bartlett were associated with year-to-year changes in production of Pacific Coast pears other than Bartlett, income, production of Pacific Coast Bartletts, and production of pears other than Pacific Coast to the extent of 86 percent for 1925–42, 72 percent for 1942–54, and 71 percent for 1925–54 (table 4). Among these factors, income appears to have been most influential on price.

The influence of changes in production of Pacific Coast pears, other than Bartlett, was in the expected direction, though less marked than the influence of changes in income. Even so, the influence of production for both periods combined was statistically significant. When the two periods were analyzed separately, the production influence did not indicate statistical significance when measured at the 5 percent level of probability. This apparent weakness may be a reflection of the fact that this broad class of pears includes five or more important varieties. Production changes among the different varieties may vary considerably from year to year, and not always in the same direction. Moreover, the overlap with the marketing of Bartletts in the fall may vary considerably from one year to another.

Effects of production of Pacific Coast Bartletts and of production of pears other than Pacific Coast were generally not significant statistically. This reflects differences in use and time of marketing. Other factors not included in the analysis, such as export demand, for which satisfactory data are not available, may have been more influential on price.

5. *Prices of Pears other than Pacific Coast.*—Approximately 80 percent of the year-to-year changes in prices received by growers for pears other than Pacific Coast were explained by production of pears other than Pacific Coast, income, and total production of Pacific Coast pears, for 1925–42, 1942–54, and 1925–54 (table 5). However, the influence on price of the latter factor was statistically not significant, denoting little or no direct competition between Pacific Coast pears and other pears. These results are in line with expectations.

Conclusions

Important conclusions that can be inferred from the analyses of the five different pear situations are given below.

1. The results for all five situations are fairly satisfactory from the statistical viewpoint. They

are most satisfactory for the situation dealing with prices for all Pacific Coast pears, for which the independent factors explained 91 percent of the year-to-year variations in price for 1925–42 and 1942–54 separately and 86 percent for both periods combined. The results are least satisfactory for the situation dealing with prices for pears other than Pacific Coast. Even here, the percentages of year-to-year variation in prices explained by the independent factors were as high as 78, 83, and 78 percent for the three periods, respectively.

2. Results for the two periods 1942–54 and 1925–54 are both good in explaining behavior of prices. The coefficients of partial determination for independent factors for 1942–54 are higher more frequently than those for both periods combined. Current and future price associations can be expected to be more nearly like those of 1942–54 than those of either 1925–42 or 1925–54. This suggests that price-estimating equations based on data for 1942–54 may be the most satisfactory in estimating price behavior in the years immediately ahead.

3. Among independent factors, disposable personal income stands out as a strong factor in explaining behavior of prices of pears for all five price situations for all periods. It is especially important for the period 1942–54. In the latter period, the effect on price of a 1-percent change in income was about twice as large as in the period 1925–42. This emphasizes the desirability of giving weight to the 1942–54 period in dealing with current and future price problems.

4. "Own production," that is, production of the class of pears whose price was being analyzed, was generally of great importance as a determinant of price. It was of greatest importance for the price situation relating to all Pacific Coast pears. It was least important for some of the classes of Pacific Coast pears for some of the periods of time covered. In at least part of these instances, price behavior appears to have been influenced by some competition of other varieties of Pacific Coast pears. In other instances, factors for which little or no data are available probably influenced price considerably.

5. Stocks of canned pears held by packers on June 1 were of considerable importance as a determinant of price in the three situations in which this factor was used. This factor was somewhat more important in the situation relating to Pacific Coast Bartletts sold for canning than in that pertaining to Bartletts for fresh use or all Pacific Coast pears. In all three situations, it was of greatest importance during 1942–54, when output of canned pears increased sharply.

6. In general, the price behavior of a particular class of pears appears to be influenced only to a minor extent by production of pears of other varieties or in other locations. Differences in use, time of marketing, and location appear to limit competition among such classes of pears.

Book Reviews

Agricultural Adjustment Problems in a Growing Economy. Edited by Earl O. Heady, Howard G. Diesslin, Harald R. Jensen, and Glenn L. Johnson. Assembled and published under the sponsorship of the North Central Farm Management Research Committee. Iowa State College Press, Ames, Iowa. 312 pages. 1958. $3.95.

SELDOM does a group, as a group, accept the challenge of reaching unanimity in describing the current agricultural adjustment problem, analyzing its causes and consequences, and suggesting research needed to resolve it. Such was the task accepted by a group of 35 leading agricultural economists in March 1957 under the sponsorship of the North Central Farm Management Research Committee. This group, which consisted chiefly of midwestern agricultural economists, contributed papers covering the major aspects of the current farm income problem with emphasis on viewing the adjustment problem and suggesting possible solutions. These papers are compiled in "Agricultural Adjustment Problems in a Growing Economy."

To lay the groundwork for consideration of necessary adjustments, a summary of the existing situation in respect to farm income, the demand and supply outlook, and the trends in numbers, size, and resource productivity of farms was presented. An analysis was then made of the basic forces giving rise to the existing income and resource-adjustment problem, followed by an inventory of empirical knowledge that might be used in making projections of demand and output and specific recommendations for adjustments. Finally, research needs and educational and policy steps were outlined that should perhaps be used in correcting resource maladjustments in agriculture and in bringing real incomes to persons employed in agriculture in line with those of other segments of our economy.

Declining farm incomes during a period of rising national and personal incomes imply that production and resource adjustments in agriculture have not been sufficiently rapid to allow resource returns and incomes comparable to those in the rest of our economy. The technological breakthroughs in agriculture, which have helped agriculture to make its contribution to increased economic progress, have caused, and probably will continue to cause, the income and resource transfer problems in agriculture. The conference accepted the main challenge of exploring the means whereby we could obtain a balance between agriculture and industry in our expanding economy. It examined the adjustments necessary within agriculture to permit society to gain from an increasingly productive agriculture and to provide comparability of resource returns to persons owning equal amounts of resources. More specifically, the group explored the following types of problems:

(1) What specific type and quantity of resources should be transferred out of agriculture?
(2) How can the agricultural plant be made more flexible?
(3) How can we improve our knowledge of the productive function so that we can devise programs to bring forth production levels for particular products that are consistent with consumer demand?
(4) How shall we allocate research money for technological research and education?
(5) What should be the structure of agriculture in terms of number and size of farms, degree of specialization, number employed in agriculture, and the optimal capital to labor ratios for particular type-of-farming and entrepreneurial situations?
(6) What modifications are needed in current farm and public programs to facilitate rather than counter these needed adjustments?

The crux of the overproduction problem appears to lie in the condition that aggregate adjustments in supply are only partially reversible. Some seemingly plausible hypotheses presented related the marginal value product of specific categories of inputs to their acquisition and sal-

vage value as an explanation of the degree of adjustment to be expected in response to price.

Among the contributing authors, there appeared to be almost unanimous agreement that major adjustments must be of a production nature, as efforts to manipulate demand through advertising and promotion cannot be expected to achieve a great deal. Population was considered to be the chief shifter of demand, while technology was considered to be the chief shifter of supply. The future race between technology and population is crucial because it was reported that a 4-percent contraction in demand for food products in a free market situation could cause the farm price level to fall by 40 to 50 percent.

Despite lower farm prices, the present trend in agricultural output is not expected to reverse itself until 1965. Based on models that projected aggregate demand and supply for the period 1955–65, it was concluded that unless more effective production-control measures are taken now, the annual surplus of agricultural production will be a chronic problem for at least another decade.

Certain institutional rigidities were reported to be impeding progress in the necessary structural adjustments suggested. These rigidities represent imperfections and immobility in factor markets other than the labor market. They consist of historical Federal land-allocation acts, present price-support and farm credit programs, acreage allotments, customs, tenure, and leasing arrangements. Major criticism was levied against current farm price-support programs that stem from successful attempts to gain protection from loss of sunken costs, thus holding resources in agriculture long after they should have been removed and often encouraging capital investments that are not justified otherwise.

Low per capita incomes per worker in agriculture imply underemployment of agricultural labor. The standard solution offered, therefore, is the reduction of the labor force in agriculture. The conference group lacked unanimity as to the short-run effectiveness of such a move. One author hypothesized that a reduced labor force in conjunction with farm consolidation, which usually means improved management on newly annexed land, could result in increased output in the short run.

Some proposals were presented as alternatives to migration in areas in which labor tends to be somewhat less mobile, and other proposals were presented as a means of increasing mobility. An appraisal was presented of local-urban industrial developments as a means of increasing the opportunities for nonfarm employment for farm families as an alternative to geographic mobility.

Despite recognition that technology has been largely responsible for our increased agricultural output, little research evidence is available with which to evaluate the consequences of its adoption on net farm revenues. Some very useful models were presented as a basis for predicting the consequences of research funds allocated for technological research in agriculture. Pilot plant operations, such as industry employs, were suggested as a laboratory in which to evaluate these technological processes.

An evaluation of past and current farm legislation and agricultural credit programs has shown them to be based on a desire to protect incomes rather than to facilitate needed adjustments. Invariably, these programs have attempted to insulate farmers from price stimuli. Until a large majority of our policymakers recognize that a need for adjustment is at the root of our farm problem, it is not likely that an effective and realistic farm program will be enacted. A combination of soil bank, flexible price support, marketing quotas, and export subsidies was presented as a modified program. The conference concluded on a note of scholarly presentation of socio-economic goals in a growing economy, farmer political behavior, and the value problem in agricultural policy.

One cannot deny that much "old ground" was covered in the papers contributed. But seldom do we find in one reference a clear statement of the adjustment problem in agriculture; an inventory of research available as a basis for evaluating present resource and production maladjustments; and the presentation of hypotheses and models useful in the development of research needed to develop effective educational and policy steps to bring about a balance between supply and demand.

The conference defined well the nature of adjustment problems and went further in outlining research needs in:

(1) Adjustment of individual farm units to technological change;
(2) Population movements to transfer labor in agriculture displaced by technology;
(3) The capital problems of agriculture;
(4) Off-farm sources of income;
(5) The type of programs needed to adjust supply and demand.

These are valuable contributions to our field. As agricultural economists, we must assume the burden of responsibility for providing the research bases for development of the policy and educational programs needed to facilitate these adjustments.

Carroll V. Hess

Land Economics. By Roland R. Renne. Harper and Brothers, New York. xiii, 599 pages. Revised Edition, 1958. $8.00.

LAND AND WATER have certain unique characteristics that distinguish these resources from other major factors of production and cause their owners and users to respond in special ways to the stimulation of economic or institutional change. The methods of owning and using land and water and their share in the national income are therefore determined according to principles whose application differ sufficiently from those of other productive factors to justify separate study. These are Renne's reasons for a book on land economics; they are reflected in the organization of his discussion.

The book is organized into six parts. Part I orients land economics in the field of social science and discusses land problems, policies, and programs. The three major purposes to which land economics and other social sciences should be directed are: First, provide an explanation of a broad area of social phenomena; second, develop a system of welfare guidance in the formulation and evaluation of social policy; third, formulate effective solutions for specific problems.

Part II deals with principles of land utilization. It includes chapters on supply and demand for land, land supply and requirements for specific purposes, the process of resource allocation, economic response, and land conservation.

In part III, land rent and income, land values and appraisal, mortgages, credit and land use, and land taxation are covered.

Part IV deals with property in land. Chapters are included on land appropriation, social control of land property, and land tenure and tenancy of agricultural and nonagricultural land.

Part V points out distinctive features of agricultural and nonagricultural land use. It also covers various aspects of water use and integration of the uses of water and land. Some of the recent developments in river-basin and watershed programs are included.

In part VI, the improvement of land use through land use planning is covered in one chapter. Another chapter on land reform has been added in this edition. This chapter deals with problems of the undeveloped countries of the world and the importance of land-tenure improvements in solving these problems.

The book would be improved if greater advantage had been taken of the opportunities to tie the illustrations back to the discussion of theory. Some of the recent contributions on benefit-cost analysis and statistical techniques applied to analysis of land and water problems might well have been included. Although public action for developing and managing land and water resources is discussed in several chapters, the growing need for legally organized local districts to provide local management is given too little attention.

In this revision of his 1947 land-economics text, Renne has eliminated much of the statistical and descriptive material and has attempted to deal more with relationships and principles. The book should be widely accepted as a text for introductory courses in land economics. The scope of topics treated should interest students wishing to become familiar with the field.

Harry A. Steele

The Niger Agricultural Project. By K. D. S. Baldwin. Harvard University Press. 221 pages illus. 1957. $5.00.

GOOD INTENTIONS are no substitute for knowledge and adequate preparation. This is the lesson to be learned from this analysis of the failure of the Niger Agricultural Project.

The purposes of the project were to settle peasant farmers on land in northern Nigeria, which had heretofore been empty, and to expand production of food—mainly peanuts for export and sorghum for local consumption. Great reliance was to be placed on large-scale, mechanized land preparation.

This scheme, which was located at Mokwa in northern Nigeria, was initiated in 1949 by the Colonial Development Corporation (British Government corporation) and the Nigerian Government. Although it was to be a commercial operation—in 1950, it was placed under the control of a limited liability company formed by the two interested parties—it wasn't expected to be very profitable. The company had responsibility for clearing the land and planning and controlling the agricultural operations. In 1954, it was liquidated and the company assets were purchased by the Northern Regional Government of Nigeria, who are using it as a pilot farm and training center.

Mr. Baldwin does a thorough job of appraising the various aspects of the project. He covers the human problems, those that involve regimentation, a feeling of insecurity and the settlers' wives, as well as the economic, agronomic, and mechanical ones. The study is objective and well-documented; it contains many references to unpublished material made available to him by the organizations involved.

The major reason for the failure was that the planning omitted the crucial stage of finding local answers to many questions on which information was not available; for example, choice of crop, planting dates, use of fertilizer, the size of acreage that could be cultivated in a hoe economy, suitable types of equipment, cost of mechanized operations, the possibility for marketing the products, and the ease with which labor could be obtained. In addition, experience gained in other areas, such as the Gezira scheme in the Sudan, was assumed to be applicable without first being tested locally.

"Other data were incomplete or misinterpreted," according to Mr. Baldwin. "Answers to basic questions by experimentation and then by small-scale pilot operations were not obtained."

Mr. Baldwin not only does an excellent job in getting at the causes for the scheme's failure, but, just as important, he writes his account in a constructive vein. His purpose is to find out "why," so that valuable lessons may be learned for future use. In this respect, the Colonial Development Corporation is to be complimented for their sponsorship of the study. Thus, although the scheme itself was a failure, much of value can be derived from it that may well be used to advantage in the future.

Sidney Gershben

Economic and Technical Problems of Australia's Rural Industries. By D. B. Williams. Melbourne University Press, Cambridge University Press, New York. 1957. $5.00.

THIS TIMELY AND COMPLETE economic analysis of Australia's present and future agricultural development is believed to be the first single work since World War II that has stressed the vital role of agriculture in the economy of Australia and, at the same time, has given proper attention to individual factors and problems that affect agriculture's part in the economic growth of the country. Analyzed in their proper perspective are such important elements as land policies, capital and credit, taxation, and extension services.

Early in the book the author points out Australia's dependence on agriculture for more than four-fifths of its export earnings. Emphasis is given also to the responsibilities that agriculture must assume in the country's overall production planning.

The present aim of the Commonwealth Government is to insure the future expansion of agricultural output to levels that will provide for domestic consumption and exports and at the same time maintain a high standard of living for Australia's future population, now increasing at about 2.5 percent a year. In this connection, Mr. Williams takes particular pains to point out the part Government has assumed in the encouragement of rural development in Australia.

At the outset, the author emphasizes the significance of the technological revolution now underway in Australia's agriculture. Later, he devotes a special chapter to the subject. His chapter treatment of this topic, however, is disappointing. Its importance in Australia's agricultural development is not emphasized sufficiently after the treatment given the subject earlier. No mention is made of the small-scale irrigation systems, dams, and water-conservation measures that have been developed over a wide area in the last few years—improvements that proved to be important in avoiding tremendous losses from the drought of 1957.

Mary E. Long

Modern Computing Methods. Philosophical Library, New York. 129 pages. 1958. $8.75.

THE READER quickly learns that this particular "cookbook" of computing methods requires a thorough understanding of "ingredients." The publication is the result of a compilation of notes used as the basis for lectures given by the staff of the Mathematics Division, N. P. L. It can only be assumed that N. P. L. refers to the National Physical Laboratory in London—the abbreviation is never defined.

These notes were part of a course, "Computers for Electrical Engineering Problems," held for representatives of various British industrial concerns. The overall course was designed to teach the basic principles in the use of electronic computers, and the techniques of numerical mathematics involved in the solution of problems in electrical engineering.

The course, and consequently the publication, deals with methods of computation for such mathematical concepts as linear equations and matrices, roots of polynomial equations, latent roots of matrices, finite difference methods and differential equations. But the reader should be forewarned. Detailed theoretical accounts of each topic are not presented. It is evident from the brief discussions that such background material was not one of the objectives of the compilers of these lecture notes. Some development of concepts is provided at times but this is not generally the rule.

The first four chapters are termed the "algebraic" part of the book, that is, those methods that pertain to determining roots of polynomials, deriving solutions to systems of linear equations, and matrix manipulations. The next six chapters are considered the "analytic" part. This refers to the type of methods used in solving varying types of differential equations: ordinary, hyperbolic, parabolic, and elliptic. The last two chapters are devoted to the tabulation and computation of mathematical functions.

Thus various methods of solution are presented. The advantages—or disadvantages—of such computation, whether by high-speed electronic computers or desk calculators, are weighed and commented upon. N. P. L. experiences with their electronic computer, the DEUCE, are detailed, as well as the advantages of certain programming techniques. Frequent examples throughout the publication illustrate the procedures to be followed. In most instances, these illustrations are oriented in the direction of engineering and the physical sciences.

The brevity with which these topics are treated is readily acknowledged. However, the appendix

contains a comprehensive list of references that supplement the text material; it is divided into sections that correspond with chapters of the book, thus providing ample opportunity for the serious reader to study a particular topic more thoroughly. A short statement about the material covered is appended to each reference.

Another part of the appendix is devoted to the electronic computers built for the N. P. L. by the English Electric Company, Ltd.—the Pilot ACE and the DEUCE. Machine components and characteristics are discussed and an example of the use of the DEUCE is given. Another section describes and explains the use of the "Mechanical Differential Analyzer," an analogue computer dealing specifically with ordinary differential equation problems.

Certainly this publication would be a welcome addition to any technician's bookshelf, but it would be of limited use to those engaged in agricultural economics. Above all, it would be an ambitious undertaking for anyone not already schooled in the topics that are covered.

Hyman Weingarten

Perspectives on Conservation: Essays on America's Natural Resources. Edited by Henry Jarrett. Resources of the Future, Inc., Washington, D. C. Published by the Johns Hopkins Press, Baltimore. 1958. 260 pages. $5.00

IN THESE ESSAYS, first presented as papers at the 1958 Forum of Resources for the Future, some of the country's foremost resource experts seek to answer these questions: What has the conservation movement accomplished during the last half-century toward wise use of America's resources? Where does the movement stand today? What are the prospects for the next 50 years, in the face of accelerated consumption caused by growing population, spreading cities, and a rising standard of living? Chief contributors are John Kenneth Galbraith, Ernest S. Griffith, Luther Gulick, Edward S. Mason, Thomas B. Nolan, and Gilbert F. White. Commentary is contributed by Bushrod W. Allin, Robert C. Cook, Harry A. Curtis, Samuel T. Dana, Charles M. Hardin, Henry C. Hart, Robert W. Hartley, Philip M. Hauser, Samuel P. Hays, Joseph L. Intermaggio, Minor S. Jameson, Jr., Robert E. Merriam, Sigurd F. Olson, William Pincus, Paul B. Sears, Byron T. Shaw, and Abel Wolman.

A mimeographed index for volume 10 is now available upon request from

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Selected Recent Research Publications in Agricultural Economics Issued by the United States Department of Agriculture and Cooperatively by the State Colleges [1]

ALLEWELT, R. W., AND MYERS, M. POULTRY AVAILABILITY AND MERCHANDISING IN RETAIL STORES. U. S. Dept. Agr. Mktg. Res. Rpt. 265, 49 pp., illus. Sept. 1958.

Report of a national survey of 6,300 stores during 1 week in October 1956. Major emphasis is on broilers and fryers, but study also provides comparisons of important elements in retailing of stewing and other chickens and of turkeys by regions, by size of city, and by kind, sales volume, and management of stores.

ANDERSON, K. E. PARTICIPATION OF SCHOOLS AND PUPILS IN SCHOOL LUNCH PROGRAMS IN ELEMENTARY AND SECONDARY SCHOOLS OF THE UNITED STATES. U. S. Dept. Agr. Mktg. Res. Rpt. 262, 48 pp. Aug. 1958.

This survey of 4,347 public elementary and secondary schools was made to ascertain the extent of school and pupil participation in feeding programs and factors associated with participation of pupils in such programs. About a third of the pupils enrolled in public schools below college level participated daily in school feeding services offering plate lunches. Half of the public schools were in the program.

BARTZ, D. J., AND BOUMA, J. C. IMPROVED METHODS AMONG WHOLESALE FOOD DISTRIBUTORS FOR INVENTORY CONTROL, SALES ACCOUNTING, AND SHIPMENT OF MERCHANDISE. U. S. Dept. Agr. Mktg. Res. Rpt. 271, 71 pp., illus. Sept. 1958.

Outlines manual and tabulating machine methods for inventory control, sales accounting, and billing of orders to retail stores. Automatic tabulating equipment will pay if annual business volume of wholesaler is at least $6 million. To operate efficiently, any department in a wholesale food distribution business should use preprinted order books. Inventory control and turnover procedures are also recommended.

BAUMANN, L. A. IMPROVING THE MARKETING OF TUNG NUTS. U. S. Dept. Agr. Mktg. Res. Rpt. 281, 31 pp., illus. Nov. 1958.

The study reported emphasized the wide variations in composition of tung nuts and the many factors that affect the oil content. Almost all tung nuts grown by independent producers are custom-milled or toll-processed. Processing and transportation charges paid by producers total about $15.50 per ton of nuts. Returns to producer depend primarily on amount of oil in nuts when delivered to processor's mills. Present methods of harvesting, handling, storing, and sampling the crop are costly and not altogether satisfactory.

BONDURANT, J. H., AND HOLE, E. TOBACCO GROWERS' COSTS AND RETURNS IN KENTUCKY BY TYPE OF TOBACCO AND LOCATION. Ky. Agr. Expt. Sta. Bul. 661, 104 pp. June 1958. (Farm Econ. Res. Div., ARS, cooperating.)

Analyzes production costs, receipts, and returns to family labor, land, operating capital, and management for burley tobacco for crop years 1951, 1952, and 1953 and for dark fire-cured and dark air-cured types for crop year 1951. Production costs exclusive of family labor, management, land, and investment for burley tobacco averaged $265 per acre; for fire-cured tobacco $145; and for dark air-cured $166. Labor used averaged 409, 356, and 327 hours, respectively. Returns to labor, land, management, and investment averaged $575, $304, and $303.

BRENSIKE, V. J. FORMULA-FEED WAREHOUSING COSTS. A STUDY IN IMPROVING EFFICIENCY IN MARKETING OF FARM FEEDS. U. S. Dept. Agr. Mktg. Res. Rept. 268, 10 pp., illus. Sept. 1958.

This is the second phase of a study of costs of operating formula-feed warehouses. Labor costs in proposed model warehouse can be reduced a third as a result of improved warehouse design, better location of feed items, and an increased rate of flow of bags of feed.

BROOKE, D. L., AND CAPEL, G. L. AN ECONOMIC ANALYSIS OF ALTERNATIVE METHODS OF CULL TOMATO DISPOSAL IN DADE COUNTY, FLORIDA. Fla. Agr. Expt. Sta. Agr. Econ. Mimeo Rpt. 59–2, 11 pp. Sept. 1958. (Agr. Mktg. Serv. cooperating.)

Four alternative methods of disposing of culls are: Processing the culls into cattle feed by dehydration, setting aside a specific area of land for dumping which would be supervised by the county or the industry, spreading culls on old or unused fields and disking them in, and using tomato harvesters to reduce volume of culls delivered from the field to the packinghouse.

BURCH, T. A., AND BUTLER, C. P. PHYSICAL AND ECONOMIC CHARACTERISTICS THAT LIMIT ADJUSTMENTS ON FULL-TIME MEDIUM-SIZED FARMS IN THE PIEDMONT AREA OF SOUTH CAROLINA. S. C. Agr. Expt. Sta. Bul. 453, 50 pp., illus. Mar. 1958. (Farm Econ. Res. Div., ARS, cooperating.)

More than a third of the operators of full-time medium-sized farms in the South Carolina Piedmont area are over 65 years old, and another 29 percent range from 55 to 64. As most of the operators over 55 have no one who will carry on the farm operations, they have little incentive to obligate themselves for either long-term or intermediate credit to finance an adjustment that would not increase net cash income for a number of years. Education and experience were also found to be limiting factors in making desirable adjustments in farming operations.

BURNS, D. J., AND WEISSENSEE, G. PROBLEMS AND PRACTICES IN MARKETING VEGETABLES THROUGH PROCESSING PLANTS IN NEW JERSEY AND THE NORTHEAST. New Jersey Agr. Expt. Sta. A. E. 226, 45 pp., illus. Sept. 1958. (Agr. Mktg. Serv. cooperating.)

[1] State publications may be obtained from the issuing agencies of the respective States.

This report is the first of 2 which will examine the marketing of vegetables through processing plants. A field survey of 56 asparagus and 56 tomato growers was made in order to describe the marketing practices and problems of growers supplying processors with vegetables.

CAPEL, G. L. COSTS FOR HANDLING FLORIDA ORANGES SHIPPED IN CONSUMER BAGS AND IN BULK. Fla. Agr. Expt. Sta. Agr. Econ. Mimeo Rpt. 58–12, 23 pp. June 1958. (Agr. Mktg. Serv. cooperating.)

This is part of an overall study of efficiency in handling and packing citrus fruits from grove through packinghouse. In comparing cost of handling and packing bulk shipments in the market with cost for handling fruit bagged at shipping point, researchers found that the bulk shipping method has a cost advantage. Terminal market firms may also use their facilities more efficiently by receiving and packing bulk oranges.

DAVIS, I. F., JR., AND METZLER, W. H. SUGAR BEET LABOR IN NORTHERN COLORADO. Colo. Agr. Expt. Sta. Tech. Bul. 63, 102 pp., illus. Sept. 1958. (Farm Econ. Res. Div., ARS, cooperating.)

Report discusses problems of sugar beet growers resulting from the declining supply of domestic sugar beet workers and increased cost of hand thinning. Intensified mechanization, as well as improvements in seed varieties, planting practices and weed control, are expected to cut down further on labor requirements. Further progress toward full spring mechanization of thinning operation depends on advancement of modern techniques, such as development of single-germ varieties and uniform planting methods.

DAVIS, V. W. NATURE AND EXTENT OF IRRIGATION IN ILLINOIS. Ill. Agr. Col., Dept. Agr. Econ. AERR24 (mimeo.), 22 pp., illus. July 1958. (Farm Econ. Res. Div., ARS, cooperating.)

A 1957 survey revealed that irrigated crops in Illinois included corn, soybeans, barley, oats, wheat, hay, and pasture and the specialty crops of vegetables, flowers, nursery crops, small fruit, and orchard crops. Largest irrigated acreage was corn, followed by vegetables, flowers and nursery crops, and soybeans. Major sources of water were wells, springs and run-off water collected in reservoirs, and natural streams. Sprinkler irrigation systems were used by most irrigators. About two-thirds of the farmers irrigating were owners, one-fifth were part-owners, and one-sixth were tenants.

DENNIS, C. C. AN ANALYSIS OF COSTS OF PROCESSING STRAWBERRIES FOR FREEZING. Calif. Agr. Expt. Sta. Mimeo. Rpt. 210, 77 pp., illus. July 1958.

Cost components considered are: (1) Dumping, (2) quality sorting and size grading, (3) slicing and the sugar system, (4) container filling, (5) casing, (6) receiving, checkout, and in-plant transportation, (7) miscellaneous equipment and materials, (8) supervisory and miscellaneous labor, (9) office and administrative expense, and (10) building costs.

DOUGHTY, H. N. CHANGES IN CASTORBEANS DURING FIVE YEARS OF STORAGE. U. S. Dept. Agr. Mktg. Res. Rpt. 264, 29 pp., illus. Aug. 1958.

Analysis of castorbeans stored for 5 years show that: (1) They store well with only small economic losses; (2) during the third year the quality of oil decreased from No. 1 to No. 3 oil; (3) after 5 years the oil still met stockpile specifications for No. 3 oil; (4) cracked and broken beans yield more oil than whole sound beans, but the quality is lower; (5) average oil content of both types tends to decrease during storage; (6) stored beans tend to absorb moisture in cold months and lose moisture in hot months, although the average moisture content declines over time.

FISHER, D. A. THE HIRED FARM WORKING FORCE OF 1957. A PROGRESS REPORT. U. S. Dept. Agr. AMS–274, 11 pp. Sept. 1958.

Nearly 4 million persons worked on farms for wages at some time during 1957, about 10 percent more than in 1956. Most of the increase was in the number of those who did less than 25 days of farm wage work, young people aged 14 to 17, and men who did 25 days or more of farm wage work.

GARLOCK, F. L., JONES, L. A., SCOFIELD, W. H., AND OTHERS, UNDER THE DIRECTION OF NORMAN J. WALL. THE BALANCE SHEET OF AGRICULTURE, 1958. U. S. Dept. Agr. Inform. Bul. 201, 30 pp., illus. Nov. 1958.

Farm assets rose to a record $187 billion on January 1, 1958. Although farm debts increased in 1957, equities of farmers and other farm property owners reached a new peak of $167 billion at the beginning of 1958. Increases in the value of farm real estate account mainly for the $10 billion increase in asset values, but another important factor was an increase in the value of livestock on farms.

GOLDSBOROUGH, G. H. NUMBER OF DAYS' SUPPLY OF FOOD AND BEVERAGES IN RETAIL FOOD STORES. A CIVIL DEFENSE STUDY. U. S. Dept. Agr. Mktg. Res. Rpt. 286, 104 pp., illus. Nov. 1958.

This survey indicated that retail food stores had slightly more than 10 days' supply of food, including nonconcentrated fluids. About 83 percent of the food was in forms normally storable for long periods. Regionally, the food supply ranged from less than 10 days in the South to almost 12 days in the West. There were about 2 days' supply of nonconcentrated fluids in retail food store inventories.

GUSTAFSON, R. L. CARRYOVER LEVELS FOR GRAINS. A METHOD FOR DETERMINING AMOUNTS THAT ARE OPTIMAL UNDER SPECIFIED CONDITIONS. U. S. Dept. Agr. Tech. Bul. 1178, 92 pp., illus. Oct. 1958.

This bulletin is an analysis of fundamental economic principles for managing a public storage program for grains. It is concerned basically with procedures that can be used to even out supplies of grain by varying the quantity carried over from year to year. Rules are developed that the administrator of a grain storage program, with the help of his economic and statistical advisors, can apply in deciding how much to store or release in any given year.

HATTON, T. T., JR., AND WINSTON, J. R. OVERSEAS VENTILATED SHIPPING TESTS WITH FLORIDA ORANGES AND GRAPEFRUIT. U. S. Dept. Agr. Mktg. Res. Rpt. 274, 20 pp., illus. Sept. 1958.

Citrus shipped in March, April, or May suffers severe decay and rind breakdown when shipped without some kind of refrigeration. Chemical treatments inhibit decay to some extent, but temperature proved to be the most important factor in preventing spoilage.

HINDS, R. H., JR. BABY CHICK TRANSPORTATION PROBLEMS AND EQUIPMENT. U. S. Dept. Agr. Mktg. Res. Rept. 267, 20 pp., illus. Aug. 1958.

The report describes some special motortruck equipment and accessories, many home-built, which are responsible for keeping shipping losses to a minimum. With the help of properly trained drivers and the specialized truck equipment described, hatcherymen can make successful deliveries in all types of weather to both local and distant customers.

HUGHES, W. F., KEATING, F. E., JONES, J. H., AND MOLDENHAUER, W. C. ECONOMIC RETURNS FROM GRAIN SORGHUM FED TO STEER CALVES ON DRYLAND FARMS OF THE HIGH PLAINS. Tex. Agr. Expt. Sta. MP–295, 15 pp., illus. Aug. 1958. (Farm Econ. Res. Div., ARS, cooperating.)

This report appraises the opportunities for dryland farmers in the High Plains of Texas to improve farm income by steer feeding, as an alternative to the sale of grain sorghum. About 220 acres of cropland would provide grain and silage for 100 steers, and on most farms about $6,300 would be needed to provide feeding facilities. At feed and cattle prices in recent years, a selling price above the initial steer cost of 3 to 4 cents per pound would result in a labor-management income equal to hired wages during the feeding period.

HUNTER, D. L., KAFER, F., AND MEYER, C. H. APPLE SORTING. METHODS AND EQUIPMENT. U. S. Dept. Agr. Mktg. Res. Rpt. 230, 24 pp., illus. Aug. 1958. (Fruit Industries Research Foundation, Washington State Apple Commission cooperating.)

The reverse-roll sorting table was modified to increase sorting efficiency. Ten to 46 percent more fruit could be sorted on this modified table than on the standard reverse-roll table. As a result of these studies, a new "float-roll" table was designed and tested. About 17 percent more apples could be sorted on the new table than on the improved reverse-roll table.

IBACH, D. B., AND LINDBERG, R. C. THE ECONOMIC POSITION OF FERTILIZER USE IN THE UNITED STATES. U. S. Dept. Agr. Inform. Bul. 202, 31 pp., illus. Nov. 1958.

Evaluates current fertilizer practices, compares output at different fertilizer levels with projected needs, and presents alternative acreage-fertilizer combinations at which projected needs could be obtained. Gives examples of use of fertilizer to minimize unit costs in meeting projected needs, and illustrates optimum use of limited quantities of fertilizer in the cropping system.

JEFFREY, A. D. PLANT RECEIPTS AND USES OF MILK IN FOUR LEADING MARKETS OF THE NORTHEASTERN STATES. Dept. of Agr. Econ., Cornell Univ., Agr. Expt. Sta. A. E. 1091, 101 pp. Apr. 1958. (Agr. Mktg. Serv. cooperating.)

Report gives detailed information on the plant receipts and disposition of milk for 4 of the principal markets of the Northeast for 1954. Detailed information on organization of these markets is given and a description and explanation of the principal marketing institutions and conditions has been prepared for each of the markets.

KING, GORDON A. THE DEMAND AND PRICE STRUCTURE FOR BYPRODUCT FEEDS. U. S. Dept. Agr. Tech. Bul. 1183, 158 pp., illus. Aug. 1958.

Describes the principal economic variables that affect the demand interrelationships among the individual protein feeds and the feed grains. Statistical price-estimating equations are presented for the aggregate of all high-protein feeds and for the principal individual byproduct feeds. Data relating to production and utilization of these feeds are also presented.

KRIESBERG, M., LEIMAN, M., AND ALEXANDER, M. THE USE OF FIELDMEN BY WHOLESALE FOOD DISTRIBUTORS AND AFFILIATED RETAILERS. U. S. Dept. Agr. Mktg. Res. Rpt. 266, 43 pp., illus. Sept. 1958.

Wholesalers employ fieldmen to help retailers operate more efficiently. Among the specific tasks assigned to fieldmen are: (1) Building sales by fostering cooperation in a joint merchandising program; (2) helping retailer build a store personality; (3) helping to increase the efficiency of the store's operations; and (4) helping the retailer improve and expand his facilities.

LANHAM, W. J., AND BUTLER, C. P. ECONOMIC ANALYSIS OF ANNUAL ADJUSTMENTS IN DEVELOPING A BEEF CATTLE-GRAIN FARM IN THE PIEDMONT AREA OF SOUTH CAROLINA. S. C. Agr. Expt. Sta. Bul. 459, 43 pp., illus. July 1958. (Farm Econ. Res. Div., ARS, cooperating.)

Outlines the annual adjustments required to develop a 161-acre beef cattle-grain farm from a representative 132-acre cotton farm. At the end of a 10-year adjustment period, estimated annual farm income will be $3,700 and return to the operator for labor and management $2,100, which is a more profitable level of farm operations than in the original organization.

LEVINE, D. B. CONSUMERS APPRAISE CANNED AND FROZEN FOODS, THEIR PACKAGES AND LABELS, IN ATLANTA, KANSAS CITY, SAN FRANCISCO. U. S. Dept. Agr. Mkt. Res. Rpt. 270, 77 pp. Sept. 1958.

Consumers approve existing containers, despite some expressed faults, such as the difficulty of opening cans or the lack of variety in frozen food container sizes. Existing labels also satisfy most consumers. They expect to find the information usually shown and would not easily accept a label that presented less information. Overall, use of frozen foods was not so widespread as canned food usage.

LEVINE, D. B. HOMEMAKERS APPRAISE COTTON, WOOL, AND OTHER FIBERS IN HOUSEHOLD FURNISHINGS. U. S. Dept. Agr. Mktg. Res. Rpt. 279, 100 pp. Nov. 1958.

A survey of 2,709 households found that cotton is the fiber most homemakers use or prefer for living-room draperies, table coverings, bedspreads, bed linen, and

scatter rugs. Wool was preferred for wall-to-wall and room-size rugs, although some homemakers favored cotton. An increased interest in man-made fibers was apparent for living-room draperies.

MACPHERSON, D. D. THE MARKET FOR CLASS II MILK IN OKLAHOMA, KANSAS, AND WESTERN MISSOURI. U. S. Dept. Agr. Mktg. Res. Rpt. 263, 46 pp., illus. Aug. 1958.

The report analyzes the market organization and structure for surplus milk in the Federal-order milk markets. It spells out in detail: (1) By whom and how surplus is handled, (2) products processed from surplus milk, and (3) where products are marketed.

PARR, KATHRYN. FARM-RETAIL PRICE SPREADS FOR COTTON PRODUCTS. U. S. Dept. Agr. Mktg. Res. Rpt. 277, 17 pp., illus. Oct. 1958.

Consumption of cotton has declined in relation to that of other fibers but still accounts for 65 to 70 percent of fibers consumed in textile mills. The 1957 average retail cost, farm value, and spread for cotton products were the same as the 1947–49 averages. The farmer's share varies among products, depending on the amount of workmanship in relation to the quantity of cotton used.

PLATH, C. V., AND GRAY, J. R. DROUGHT PRACTICES USED BY SOUTHEASTERN OREGON CATTLE RANCHERS. Oreg. Agr. Expt. Sta. Cir. Inform. 591 (mimeo.) 6 pp. Aug. 1958. (Farm Econ. Res. Div., ARS, cooperating.)

Evaluates alternatives available to cattle ranches in southeastern Oregon in adjusting to conditions in the drought year of 1955. Ranchers able to lease more range or hayland came out best financially, and buying of hay was the second best method of meeting the problem. Purchase of concentrates was generally less satisfactory than purchase of hay. Ranchers who were forced to reduce their herds to meet the feed shortage suffered a severe drop in income.

PODANY, J. C. COSTS OF MARKETING FLORIDA POTATOES. PACKINGHOUSE TO WHOLESALE RECEIVER. U. S. Dept. Agr. Mktg. Res. Rpt. 233, 15 pp., illus. Aug. 1958. (Fla. Agr. Expt. Sta. cooperating.)

Provides information to producers, packinghouse operators, and others on cost of marketing Florida potatoes and relates these costs to services performed. It also describes the marketing margin for Florida potatoes from packinghouse door to point of first transfer of ownership to firms in Chicago and New York City.

RAUCHENSTEIN, E. SELLING FARMS ON A PRODUCT-PAYMENT BASIS. Wis. Agr. Expt. Sta. Bul. 534, 12 pp., illus. Sept. 1958. (Farm Econ. Res. Div., ARS, cooperating.)

Outlines a plan by which sellers of farms might share with buyers the gains and losses that may arise from changes in prices during the period of installment payments. The seller of a dairy farm, for example, might agree with the buyer to receive as his annual payment the value of a specified quantity of milk.

ROGERS, R. O., AND STUCKY, H. R. COTTON HARVESTING. A COMPARISON OF MACHINE VS. HAND PICKING. N. Mex. Agr. Expt. Sta. Res. Rpt. 17 (mimeo), 30 pp., illus. Aug. 1958. (Farm Econ. Res. Div., ARS, cooperating.)

With 1957 costs and prices, mechanical cotton picking is economically feasible when a 1-row picker is used as much as 200 hours on upland cotton at a harvesting rate of at least 490 pounds of seed cotton per hour, or is used as much as 160 hours on long-staple cotton at a harvesting rate of at least 350 pounds of seed cotton per hour. Comparable figures for a 2-row picker are 250 hours on upland cotton at a rate of 756 pounds per hour, or 165 hours on long-staple cotton at a rate of 525 pounds per hour.

SHAFFER, P., ANDERSON, D., WISCHKAEMPER, P., AND KARITAS, J. PACKAGING AND PRICE-MARKING PRODUCE IN RETAIL FOOD STORES. A STUDY OF IMPROVED METHODS OF MARKETING AGRICULTURAL PRODUCTS. U. S. Dept. Agr. Mktg. Res. Rpt. 278, 85 pp., illus. Oct. 1958.

Improvements in packaging, price-marking, and unitizing of produce for self-service were installed in 4 supermarkets. The various methods used are described and the savings on labor and material analyzed. Weekly savings ranged from $22 in the market with produce sales of $1,800 per week to $67 for the one with produce sales of $6,450.

STANIFORTH, S. D., AND CHRISTIANSEN, R. A. THE ROLE OF OFF-FARM EMPLOYMENT IN RURAL DEVELOPMENT—A STUDY OF LOW INCOME FARMS. Wis. Col. Agr., Dept. 14 pp. June 1958. (Farm Econ. Res. Div., ARS, cooperating.)

Off-farm employment among FHA borrowers is explored as an aid in movement out of agriculture or in moving from part-time to full-time farming, and also as a permanent way of life in combination with part-time farming.

THOMPSON, J. W. RENDERING INEDIBLE ANIMAL FATS. ANALYSIS OF PRACTICES IN PENNSYLVANIA AND MINNESOTA. U. S. Dept. Agr. Mktg. Res. Rept. 283, 62 pp., illus. Nov. 1958.

Describes the collection of raw materials, the production, and the marketing of tankage and inedible tallow and grease in these 2 States. Recommendations directed toward greater returns through more efficient operations and production of high-quality products are made.

U. S. AGRICULTURAL MARKETING SERVICE. SPECIAL STUDIES OF MARKETING COSTS AND PRACTICES. U. S. Dept. Agr. Mktg. Res. Rpt. 240, 21 pp., illus. Oct. 1958.

The farmer's share of the consumer's expenditures for food products in retail stores in 1957 averaged 40 percent. Farm prices of food products were 3 percent higher in 1957 than in 1956. As a result of these increases, retail food prices were higher in 1957, but the major rise came from higher marketing costs.

U. S. AGRICULTURAL MARKETING SERVICE. USING YOUR COMMUNITY'S HEALTH RESOURCES. U. S. Dept. Agr. Rural Resource Leaflet 5. Aug. 1958. (U. S. Public Health Service cooperating.)

A guide for rural planning groups.

U. S. GOVERNMENT PRINTING OFFICE: 1959

U. S. BUREAU OF THE CENSUS. ESTIMATES OF THE FARM POPULATION OF THE UNITED STATES, APRIL 1950 TO 1958. Series Census-AMS (P-27), No. 25, 4 pp., illus. Aug. 8, 1958. (Agr. Mktg. Serv. cooperating.)

About 20,827,000 persons were living on farms in April 1958, a decline of 4,231,000, or 16.9 percent, from the estimated farm population in April 1950. Farm population has been steadily decreasing. In 1910, 1 in 3 persons lived on a farm. By 1950, 1 in 6, and by 1958, only 1 in 8 was a farm resident. An increasing number of families whose livelihood is not gained directly from agriculture live on farms.

VLASIN, R. D., AND EPP, A. W. ALTERNATIVE CROPPING SYSTEMS FOR SOUTHWESTERN NEBRASKA. A COMPARISON OF NET RETURNS FROM VARIOUS CROP COMBINATIONS. Nebr. Agr. Expt. Sta. SB 443, 35 pp., illus. 1958. (Farm Econ. Res. Div., ARS, cooperating.)

Reports the results of a study made to learn whether wheat farmers can earn a higher income by producing various alternative crops than by growing wheat alone. Alternative cropping systems considered were wheat-fallow, wheat on fallow plus an alternative crop grown on stubble, and wheat and an alternative crop grown on fallow. Net returns from wheat were higher than any other crop studied; of the alternative crops, grain sorghum gave the highest returns, followed by barley on stubble, proso on stubble, safflower on stubble, safflower on fallow, and oats on stubble.

VOGLOM, C. J., ASKEW, W. R., AND BRENSIKE, V. J. CUSTOM FEED MILLING IN THE MIDWEST. MODEL PLANT OPERATIONS, COSTS, AND CHARGES. U. S. Dept. Agr. Mktg. Res. Rpt. 275, 23 pp., illus. Sept. 1958.

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